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The Davis Flanging Machine.

Our illustrations represent an improved flanging machine, designed for the use of boiler makers in flanging heads of any size from 38 to 96 inches diameter, and of any thickness required within those limits of size. Under ordinary conditions, its capacity is limited only by the number of heads, which can be heated, as the flange is turned at a single heat, and so quickly that it is still red-hot when completed, and taken from the machine.

In the center of the machine is a revolving plate, driven by a powerful train of gears, and a belt, as shown, or, if preferred, by an engine, and which is adapted to receive and drive the former over which the head is formed.

At the back of the machine, Fig. 2, are two arms having T slots, by which are attached gauge blocks, having swinging pieces, by which the head is centered on the former.

The follower plate is then brought down onto the head by means of the screw and hand-wheel at the top. This follower is so made as to bear hardest at the outside, and comes down with an outward pressing motion, which keeps the head straight and flat on the former while being turned.

The machine is then set in motion, and the straight or "break-down" roll brought against the edge by means of the large screw in the bed.

This roll is so mounted as to enable it to be presented at any desired angle, and can then be gradually brought to a vertical position by means of the hand-screw on the carriage, being kept up to the head at the same time, by means of the large hand-wheel and screw.

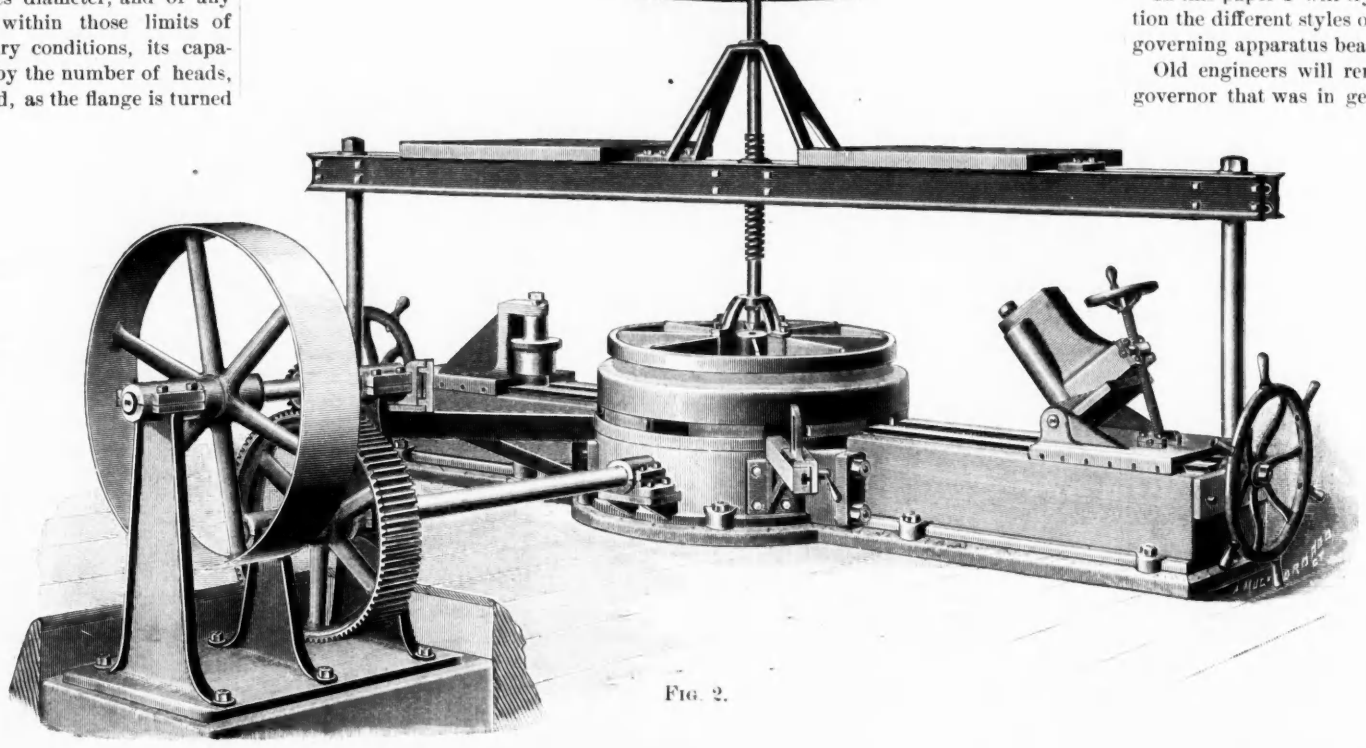
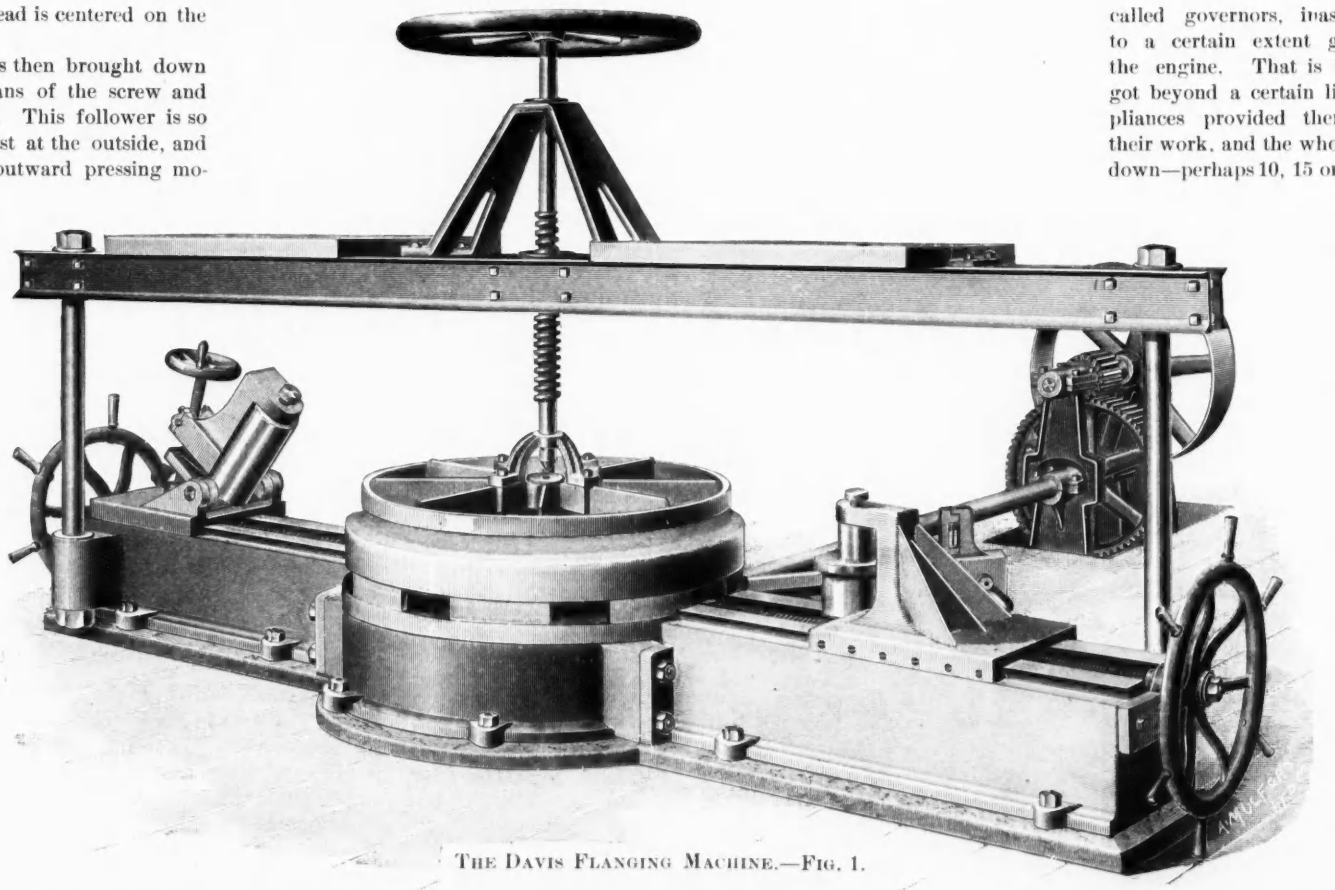


FIG. 2.



THE DAVIS FLANGING MACHINE.—FIG. 1.

The finishing roll, which is made of the shape it is desired the head to be, is at the opposite side of the machine, and is brought up to the head in the same manner, though it is fixed in a vertical position. As the first roll is bringing the edge of the head down to the former, the finishing roll is brought up, and completes the head.

Hooks are placed in the follower, which take hold of the lower edge of the head, so that it is drawn off by means of the hand-wheel and screw on the top of the machine.

As will be perceived, the machine is simple in construction, so that it is not very liable to derangement. At the same time, it is easy to manage, rapid in operation, and the work when done is true and ready for use. The builders are I. B. Davis & Son, Hartford, Conn.

Brazil has declared herself to be a republic, and reasoning from conditions in the United States a good many people—workingmen especially—have thought it a good country to emigrate to. But the contrary of this seems to be true. From all we can learn just now, Brazil is an excellent country for workingmen to stay away from. After a little time, when the citizens have settled down to business, Brazil will be a great country, no doubt.

The Modern Steam Plant and its Management.

BY PETER H. BULLOCK.

In this paper I will try and show the relation the different styles of valve motions and governing apparatus bear to even speed.

Old engineers will remember the style of governor that was in general use before the days of variable cut-off engines. It had two balls on the ends of rather long rods, and when the engine was at rest they usually hung nearly vertical beside the spindle that supported and gave them motion. The tops of these rods were jointed by suitable bell crank levers and rods to a "butterfly" or some other kind of alleged easy working valve, located in the steam pipe somewhere between the engine and boiler. These were by courtesy called governors, inasmuch as they did to a certain extent govern the speed of the engine. That is to say, if the speed got beyond a certain limit, the various appliances provided therefor would get in their work, and the whole thing would slow down—perhaps 10, 15 or 20 per cent. Let us see why: Because the movement of the governing apparatus was somewhat indirect in its action, the valve comparatively hard to operate, and often too far from the steam chest, but principally because the governor began to act as soon as the engine was started, and the whole range of its motion was distributed between 0 and the speed limit. It may be taken as a rule that the larger range of motion that can be given a governing apparatus, the more even will be the speed; but this rule should also have the proviso that this range of movement should be limited to the smallest possible range of speed. That is, the governing apparatus should not begin to act until nearly the required speed has been reached, and then the largest movement between that and the maximum speed should be provided for.

About the first governor constructed on

this principle was, if I mistake not, the Porter. In this the centrifugal force of the revolving balls was counteracted by weights that remained at rest, and had to be lifted by the governor before it could begin to act. It will be seen that it would require a certain speed to overcome this, and that the weight could be so adjusted that this joint would be the minimum speed required. This was a long step in the right direction, and was accompanied by an easy working valve, placed directly on the steam chest. In fact, there are no governors now made, in which this principle is not recognized in different provisions made for carrying it out, and with more or less success, according to the means employed for the purpose. Another advantage of a distinct force opposing the centrifugal motion of the revolving balls, is that it is constantly pulling the valve open, and any change of speed will be more quickly answered than if the gravity of the moving balls were alone depended upon. This principle is very nicely carried out in the three-ball and ribbon spring governors, so generally used on reversing engines, directly attached to elevators. There is no class of engines known to the writer, where such variation in load occurs as in these, as it is from their full capacity in hoisting a heavy load, to being pulled in the other direction by the same load being lowered. Often this variation will occur in a single second, or as quick as the elevator boy can pull the shipper rope, when he has got by the landing where he should have stopped. The average elevator boy, however, does not often exhibit such dexterity during business hours—he reserves all speedy movements for the last trip.

Some years ago a governor was brought out, in which balls and springs were replaced by a paddle wheel loosely fitted in a case partly filled with oil. The case was supported on the paddle wheel spindle, and on which it was free to revolve one full turn. The case was impelled in the same direction as the revolving paddle wheel, but this motion was opposed by weights that could be so adjusted that the case would not begin to move until nearly the required speed had been reached. A small gear on this case, acting through a segmental gear and lever, operated the valve, or was connected to the regulating cams of an automatic engine, as the case might be. These governors were very sensitive to any change in speed, and to discover why this was so was the first real hard study the writer ever indulged in, and resulted in my finding out for myself what any bright fellow would have seen at once, and which I might have forgotten, had it been told me; for the value to us, of a thing learned, is often in just proportion to the ease with which we acquire it. It finally came to me that the case had a range of 360 degrees after it bgan to act, while the ball governor it had replaced had only a range of 26 degrees in which to accomplish the same work. The means may have been faulty, but it had the right principle, inasmuch as its action could be confined to a small limit in speed, and it utilized a force acting through the entire circle, while few ball governors get even an eighth part as large a movement, and part of this is wasted in beginning to act too soon.

To properly regulate an engine, however, more things must be considered than the sensitiveness of the valve motion, and its controlling power, for other conditions may exist that will counteract any refinement in that direction. Let us see how different methods operate to produce the same results, and I will illustrate by two engines running to-day. One is an old Corliss 26 x 60, running 44 turns per minute. It has a very heavy fly-wheel, runs well and regular, and has never had or needed but very few repairs The other is 14 x 24, runs 210 per minute, has a very light fly-wheel, and runs well and regular, like its venerable neighbor. Why this same desired result from so dissimilar conditions? In the first, regularity is secured through the inertia of the heavy fly-wheel, and eighty-eight chances each minute for variation in the amount of steam admitted. In the latter, the inertia of revolving weight is very largely dispensed with, but the number of times regulation can take place in each minute is increased to four hundred and twenty. The valve motion of the latter engine is well designed, its regulation is within the desired limits, and this, in connection with the great number of times regulation may take place in a minute, makes it a very even running engine. The valve motion of the old Corliss is also good, but it has too wide a range of regulation; still, it gets there about 44 times each minute. It uses more steam per horse-power, per hour, than the smaller engine, which is principally due to the higher pressure and greater piston speed of the latter.

The above, however, is by no means the limit that the two systems of regulation may be carried, for the weight of moving matter may be made so ponderous as to require regulation in the amount of force imparted, but few times in each minute, while in the other direction the speed may be increased to such an extent that fly-wheels intended as such can be entirely dispensed with. I have seen a 3 x 5 automatic engine, the pulley of which was made as light as safety would permit, run six hundred turns per minute, under a load varying from 0 to nearly its full capacity. The greatest variation in speed noted was less than 10 per cent. under the greatest load, and of course this was due to the excellent distribution of the steam, and the great number of times regulation took place in each minute. To the same principle of rapid regulation is due the very even speed of the best electric motors, as in them the amount of energy imparted is automatically determined many thousands of times each minute.

It will be seen that proper regulation wholly consists in determining the necessary amount of force to be imparted, and a fly-wheel cannot be consided as belonging to the regulating part of an engine; for, although it acts as a storage of force, making it unnecessary for so frequent changes in the amount imparted, still it has no direct effect on the true cause of regulation. The most perfectly regulated engines, therefore, must be those in which the range of time and speed is limited as before mentioned, and the chances for regulation the most frequent.

It is the easiest thing in the world to form an opinion, and the hardest thing to establish a fact.

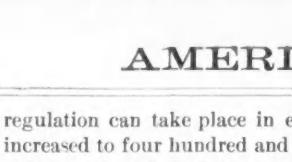
Loam Moulding.

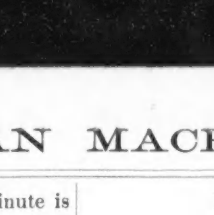
BY S. BOLLAND.

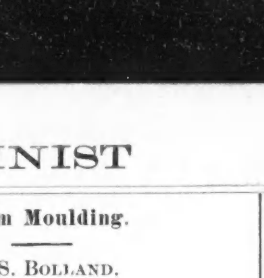
SECOND PAPER.

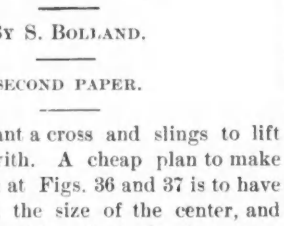
You now want a cross and slings to lift your mould with. A cheap plan to make the one shown at Figs. 36 and 37 is to have a square block the size of the center, and one leg. By making it staple down you may cast it open sand. Amongst the tables given at the end of these articles, one will be found giving the strength of beams, by the use of which a safe estimate of the required depth and thickness may be made. The slings can be made as shown at Fig. 38. You now lift off the cope, setting it up high enough to work under.

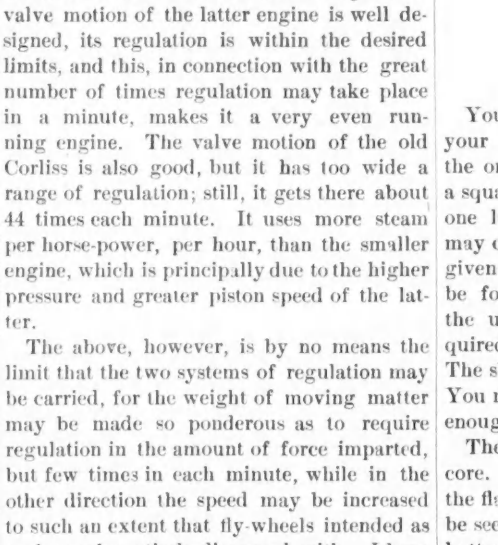
The next thing to be done is to build the core. Take away the sand which formed the flange, and set the core sweep. As will be seen at *D*, Fig. 29, this sweep rests on the bottom, and is the full length of core and head, including shrinkage. It will not be as firm as the cope board was, on account of being braced at the top only, but you can improve that by using a temporary clip, as shown at *E*, Fig. 29, which is simply two boards, long enough to reach from spindle to sweep, through the center of which a half-inch bolt is screwed tight. It will be necessary to use the gauge stick (Fig. 31) in setting this board, this being much more reliable than the rule. Build a few double courses at the bottom, crossing the joints as you go, build up to the clip, and then rough and finish this part of the core. The reason for doing this is that, by finishing the bottom of core whilst the clip is on, the correct diameter will be secured as well as being perfectly round (something very difficult to accomplish when the sweep swings loose from the top), and serves as a guide to finish the top of the core by. When the rest of the core is built, and before you rub on the loam, tie it in two or three places with soft wire; this keeps the brickwork firm, and resists the jar caused by running in and out of the oven. The reason for building double bricks at the bottom is because the greatest pressure comes on at the bottom, and, unless extra precautions are taken, the core is pressed in and the hole is much too small, giving considerably more work in the boring than is required.

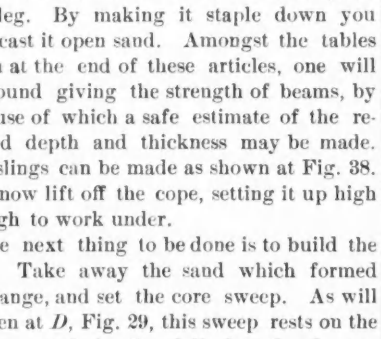












LOAM MOULDING.

Your core being skinned up, you must now turn your attention to the portion of cope from top of flange, shown from *B* to *C*, Fig. 24. This part must be formed in the covering plate, and will rest on both cope and core. To accomplish this you require another plate, the outside diameter of which will be the same as the brickwork at the top flange, whilst the inner diameter will correspond to the inside of brickwork of core. Figs. 39 and 40 show elevation and plan of plate with sweep in position. It will be seen at Fig. 39 that provision is made for running, these holes being cast in so that the gates can be set over the center of thickness. The prickers are shown between which bricks must be built. As this sweep corresponds with the cope-board in its diameter, that would be the guide in laying out the plate, making sure of an inch clear of the sweep. The small prickers are 1½″ long, and can be rammed hard with dry sand facing, but the bricks between the long prickers must be roughed up with loam, and then all can be skinned up together. When stiffened sufficiently, the gates can be cut through.

By referring to *F*, in Fig. 29, you will observe how the guide is made to insure the correct position of the covering plate. By leaying a square edge same distance from center on the covering plate, as seen at *F*, Fig. 40, the two parts can be closed as accurately as if you had the inside of the mould to go by. This system of guides will answer in all cases where they can be swept on.

To facilitate the laying out of the gates, a small notch must be cut in the top plate sweep, as shown at *A*, Fig. 40, so that, when you strike on the skinning loam, there will be a ridge all around, corresponding with the diameter of core (suppose the casting to be 2″ thick, this mark would be 2″ from the outside). It is important that care should be taken in this, so as to avoid striking either cope or core. Should your covering plate for other work be without any portion of the mould to guide you in this particular, any number of notches may be cut for the purpose of showing the thickness. (See Fig. 41.)

It is important that the gates be well distributed around the cylinder, as the more gates you have the cleaner will be the casting, as they serve to break up and keep in motion the scum which rises as the casting is being poured. A larger hole is shown, which serves as a riser or feeding head. It is not possible at all times to gate the mould evenly all around: should there be cores or projections in the way, provision must be made for this when the cover plate is made, and the holes placed where they will miss them.

You must now finish the several parts ready for the oven. First go over the skinned parts of the cope with such tools as are needed to fit the different parts of the mould, taking care not to alter the shape. Should any part have become too hard to finish easily, brush a little water over, to moisten the surface.

A different operation is needed at the bottom flange. After cleaning off the parting sand which adheres to the loam, and scraping it true, rub up the surface by brushing over some thin skinning loam, and with a rubbing stick, in the form of a segment of the flange, scrub it evenly all around. When the skin made by the oil is thoroughly broken, and the surface is good and true, brush a little skinning loam all over, and finish with the proper tools, as before. Never use tools unsuitable, as the mould would be all humps and hollows. If you have not the proper tools, it will be better to make the mould as good as possible with the rubbing sticks, which is very often done. Pay particular attention to the core; whatever fixing is required let it be done with the rubbing stick alone, which, in this case, would be a piece of soft wood 18″x3″x2″.

My reason for so much caution in the use of tools are these: First. There is danger of losing the original design from the unskillful use of them. Second. The least use you make of them, the less danger of

scabbing, as repeated sticking brings the clay to the surface in thin, hard cakes, which usually comes off in thin scabs when the casting is poured.

Blacking the parts is to be next considered.

This is a very important feature in the trade, as, no matter how much pains may have been taken in other ways to secure a handsome casting, it will be all marred by not having the right mixture of blacking for your job, and using it in the right way when it is made. For the job in hand, and all other work of a similar kind, the following mixture will be suitable:

Blacking mixture for general work, from $\frac{3}{8}''$ to 4″ thick.

To 1 of best mineral add $\frac{1}{2}$ of best heavy charcoal,

$\frac{1}{4}$ of X X silver lead,

$\frac{1}{2}$ of hard Lehigh blacking.

Wet with clay water that will just color the hand, but be sure and not overdo with clay; mix well, and pass through a fine sieve.

In blackening your mould use flat brushes, as they lay the blacking more evenly than the others; cover the surface of the cope to the depth of $\frac{1}{16}''$, and finish carefully with your tools, taking care not to slick any more than is necessary. When the mould is nicely finished, you can paint it all over with a thin mixture of XX silver lead and molasses water, using a flat camel's-hair brush for the purpose.

In blackening the core, brush on evenly $\frac{1}{16}''$ thick, leaving as few brush marks as possible, but do not attempt to slick it. Cores must never be slicked, because, the surface being convex, the skin of the loam is easily loosened with the tools, and a scabbed core is the result. You may slick the flange face at the bottom of the core, and go over with the lead wash as on the cope, but the body of the core will not need it.

The covering plate being finished after the manner described, the whole of the parts must be thoroughly dried. When dry, have the pit in which your mould will be closed for casting, dug deep enough to leave about 3′ above the floor.

By a careful examination of Figs. 42 and 43, the method of closing, binding, and ramming will be seen. *A* and *B* are the guides, *C* is the floor line, *D* the cross on which are hung the slings *E*, which are set under the bottom lugs *F*, and made taut by hoisting on the cross. When all is snug, and every sling is tight, packings *G* must be set under the cross on top-plate *H*, and wedged securely between, taking care that the wedges bed close to cross and packing.

I would here observe that wedges should never be put in singly where it can be avoided, and wrought-iron is always preferable to cast, on account of the liability of the latter to snap, thereby endangering the success of your work.

The cross can now be lowered off, leaving the mould firmly bound together. The joints *A*, *B*, *I*, must now be stopped in safe by rubbing in thin mud, and all is ready to commence ramming.

At *J*, *K*, *L*, *M*, is shown curbs of wrought-iron; they may be from $\frac{1}{16}''$ to $\frac{1}{8}''$ thick, according to the class of work they are needed for; the lengths may vary from 8 to 10 feet.

It is well to have a few shorter ones, as they are handy for shortening up or lengthening out, as may be required. Have the holes punched for $\frac{1}{2}''$ bolts, snug fit, about $1\frac{1}{2}''$ from the end; about four holes in a two-foot plate, and three in a 1′ 6″. Use washers in bolting, and be sure that you screw them up close. A few stronger plates may be kept for the bottom course of deep moulds, with an extra bolt hole in. In ramming, judgment must be used, so as to save labor. As the greatest pressure comes on the bottom, let the ramming be extra firm at the lower courses, decreasing gradually as you come to the top. The moulder, or some trustworthy man, will superintend this part of the work, using a pin rammer close to the bricks, the rest with flat rammers, keeping 3″ back. The monotony of the labor will be considerably lessened by all hands keeping time as they ram.

It will be seen in Figs. 42 and 43 how to make the runner. As shown, a few courses of brick are laid up to the inside of top plate, to keep in the sand, or a ring of iron may be set on for that purpose, if there is one handy. As seen at *O*, the riser is much larger than the runners. Keep the plug in the riser when you pour, and have a man ready with a rod to lift it out as soon as the iron touches it. Be sure to have a few shavings down at the bottom of core, and light them before you commence to pour; this serves to rarefy the cold air in the core, and makes it easier for the gas to escape as you cast. Some moulders say, keep all risers open, and allow the gas to free itself from the mould, thereby insuring a cleaner casting; but I am of the opinion, that whatever good it serves in that direction is more than neutralized by the consequence of such a method. By keeping all risers closed, the air inside the mould is confined, the expansion of which (as soon as the iron enters) serves a very good purpose; pressing, as it does, on all its parts, and binding the surface firmly to the brickwork; whilst, on the other hand, if they are left open, the draught and roar acts in the opposite way, creating a suction which draws off the surface, and causes scabs and buckles.

I have been describing the method of ramming moulds in curbs, but, as I well know, all shops do not have them, and must, in consequence, ram in the floor. Where such is the case (and a pit has to be dug where it is the most convenient) make sure that you dig back to good, solid ground, no matter how much extra time it takes. If this should be neglected, it matters little how much you ram around the bricks; there is great danger of giving way, and the casting being lost. So that, considering the risk you run, and the small cost of curbs, it will be readily seen that the safest method will, in the end, be the cheapest. Some have bricked pits, which are good for special work, but when your job is much smaller than the pit, and you must fill the extra space with sand, to be thrown out again, curbs would save money.

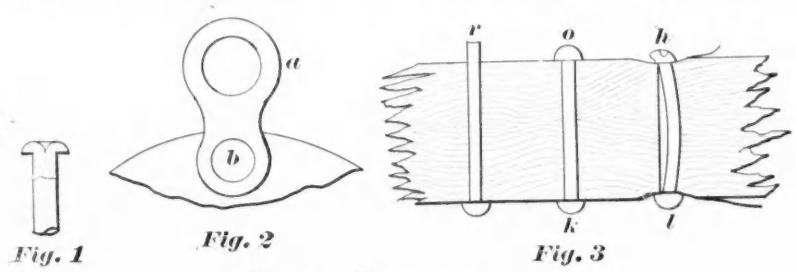


Fig. 1 *Fig. 2* *Fig. 3*

RIVETING EXPERIENCE.

"It has been Proved"—Riveting Experience.

BY JARNO.

Among the strongest words that we know anything about, are these: "It has been proved." Whatever we know comes from experience and from proof. We honor the man that, from his own experience, gives us something that is an addition to our pleasure and to our knowledge; and to him that comes with a new proof, we ever listen with rapt attention.

In the AMERICAN MACHINIST of Oct. 31, '89, Mr. Henry Long says: "In your issue of Sept. 26th, an article on riveting appears, which calls for some criticism. The writer appears to advise the use of the automatic riveting hammer for light work, whereas, it has been proved that the correct principle on which to set a rivet is by no means of compression. Hydraulic, steam, and lever riveting machines, with one single exception, use that system, and for light work, such as the writer describes, a simple punch and die are the most efficient tools that can be used."

In positiveness this quotation does not lack anything that would go to make it rank with the enunciation of a general principle; hence, my attention was at once arrested, and still more because I wrote the article of Sept. 26th, I read Mr. Long's letter with great interest; as it were, my attention was *riveted*.

Many things are never called into question, but are taken as general principles, because they were proved so long ago, because they have since been so often proved, and in consequence so long accepted, that to consider them other than as certainly known would be regarded as misapplied thought, and misspent time. No one ever doubts that the sum of the three angles of a triangle is equal to two right angles, though the proof is sometimes gone through with; yet the purpose is to illustrate the proof, and not the fact. Every blacksmith and every machinist knows that the quick blows of a light hammer will enlarge the end of a soft metallic rod, and that the slow blows of a heavy hammer or sledge will enlarge the body of the rod. Still more than a sledge does the slow-moving press or riveting machine tend to enlarge a rod or rivet throughout its entire length. Mr. Long recognizes this principle when he says, "By using a hand hammer, you can turn the edge over, and thus make a good set."

Since reading Mr. Long's letter, I have had the pleasure of an evening with Mr. C. H. Norton, who was my informant in regard to the riveting hammer. In substance, the most of this paper was given by him from an experience of twenty-two years in a factory where the question of how best to do light riveting was frequently discussed; fifteen years of the time in a department that used half a ton of small rivets in a year.

In asserting that a machine cannot be made to do perfetly the work of a hand hammer, in setting a rivet, Mr. Long has made a mistake, because six riveting machines have been in successful operation for more than eight years. His experience has, no doubt, led him to think that he cannot make such a machine, but he would probably change his mind if he should see the one that I described. A statement that does not include the fact of the use equal to one machine for forty-eight years, is incomplete, and the one that excludes the forty-eight years is erroneous; it is made upon a supposition; it lacks the dignity of a theory or general principle, and can hardly be called even a hypothesis. In obtaining experimental knowledge, it is sometimes necessary to collate many facts, and whatever is contrary to any fact can never be said to be proved. In arriving at a conclusion, a man may leap a logical chasm and yet think that he is correct; but a machinist well knows that a machine never overlooks a mistake, never accepts an apology; if he gets his head in the way, instead of slotting his work, a planer will plow a groove through his skull. Equally certain it is that a machine, correctly constructed and rightly run, does its work with unerring regularity; a machinist knows no better proof that he has reasoned correctly, than to have a machine work as he expected. High in the world of thought is the aim expressed by mathematical precision; equally high in the world of action is mechanical precision.

Knowing the principle that the quick blows of a light hammer will head a rivet by expanding right at the end, with but little tendency to expand the body, and remembering that the machine hammer is light, and strikes quick blows, twenty in a second, it is not hard to understand that the machine hammer forms a head that has a firm set, and that the neck is not much expanded. Still, if a hand hammer does not, and a machine hammer does strike a direct blow on the end, Mr. Long has raised what would be a reasonable doubt of the machine's doing the work of a hand hammer before the machine is tried; because a real variation in any condition may vary the result. But the rivets were so small and so short that they could hardly be headed by other than direct blows, and one of the troubles was uneven hammering. Hence, the variations in the conditions that Mr. Long suggests did not exist. Every doubt has been struck out of the minds then that have seen the machines work. The cupped die that strikes the rivet makes a well-formed and finely polished head, which is important, because the work is afterwards nickel-plated. A head like Fig. 1, such as Mr. Long recommends, will not do, because the depression made by the center point does not plate well, and a dark unpolished spot is left after the work is buffed.

When riveted in a press, Mr. Norton's experience has been that thin plates are more likely to buckle, and are less firmly held together, than when riveted with the machine hammer. His explanation is that, unless the plates are together at the start, a press tends to expand a rivet along its body, and make it bind on its sides, and hold the plates apart, so that the head cannot bring them together. Even though the body does not fill, a pressed cold rivet does not so firmly hold the plates together as a hammered rivet. In some work this is an advantage, as in Fig. 2, in which *a* is a pendent that should turn easily on the rivet *b*. When thick plates are to be held together so that they will not turn, square holes can be put through them, and the bodies of the rivets made to fill the holes by using a press.

For some work a press will not do at all. To illustrate, let us take an extreme case like Fig. 3, in which we will try to rivet a thin, soft, metallic plate to each side of a thick piece of soft wood, with a small rivet *r*. We try either a light hand hammer or the machine hammer, and the result is like *o k*. We now try the press, and find that the rivet acts like *h l*.

Mr. Long mistakes in saying that a machine *must* strike a direct blow, because there is now one that is neither a hammer nor a press, which forms a head on each end of a rod at one time—two heads at once. It consists of two rapidly revolving spindles that carry each roll for forming the head, the action being something like that of spinning. This machine easily does work that can hardly be done in a press, and with difficulty by a hammer.

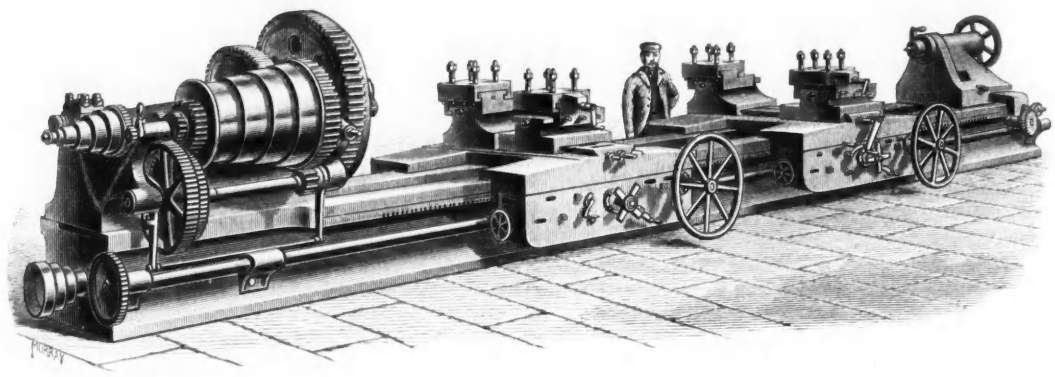
This brings us to the gist of the article of Sept. 26th, which was to show that the manner in which a piece of metal yields to pressure depends somewhat upon the speed with which the pressure is applied. The machine that rolls or spins is a case in which the pressure must be applied by something that has a high speed. To punch a half-inch hole through a piece of iron, two inches thick, the punch must have a slow speed. Though Mr. Long said that my article called for some criticism, yet he has not shown that I asserted anything contrary to experience or inconsistent with reason. An opinion without a reason is not criticism. The authority of a real proof is higher than the dictum of anybody that we know, but nothing that is contrary to experience can ever be proved.

In spite of the low wages paid to skilled mechanics in Glasgow, the cost of building a locomotive there is considerably higher than it is in the United States. When Bret Harte was American Consul in Glasgow, one of his reports to our government brought this fact out very decidedly, but the accuracy of his conclusions was questioned by those concerned in promoting British interests. We recently learned something that appears to strongly corroborate the correctness of Consul Harte's conclusions. A British locomotive building company, noted for the fine equipment of tools used and the advanced system of production followed, built 200 locomotives last year, while employing on an average 2,500 workmen; a well-known American firm in the same time built 300 locomotives while employing 1,400 workmen. —*National Car and Locomotive Builder.*

After all the talk about the World's Fair, there is really, at this writing, no very good reason why it should not be held in New York City. But it is coming to be a question of time. Haste has been made quite too slowly.

A Heavy Crank Shaft Lathe.

With this we present illustrations giving a perspective view and details of a 48″ crank shaft lathe, which possesses some noteworthy features. The bed, which is 35′ long, 42″ across the top, and 24″ deep, weighs about 34,000 lbs., and when supported at the center shows a deflection test of $\frac{1}{16}$″. The main spindle is of hammered steel, with bearings 10″ diameter, and 12″ long. From the four speeds of the cone pulley there are derived, by means of the system of gears, twenty-four different speeds, which are in regular gradation from the slowest to the fastest, in addition to which there are two speeds given the counter-shaft, making in all forty-eight speeds for the face plate. At the slowest speeds this plate is driven by means of the teeth upon its periphery, a steel pinion 8″ diameter working into it. This pinion may be moved in or out of engagement by means of the small hand-wheel in front of the bracket, Figs. 2 and 3.



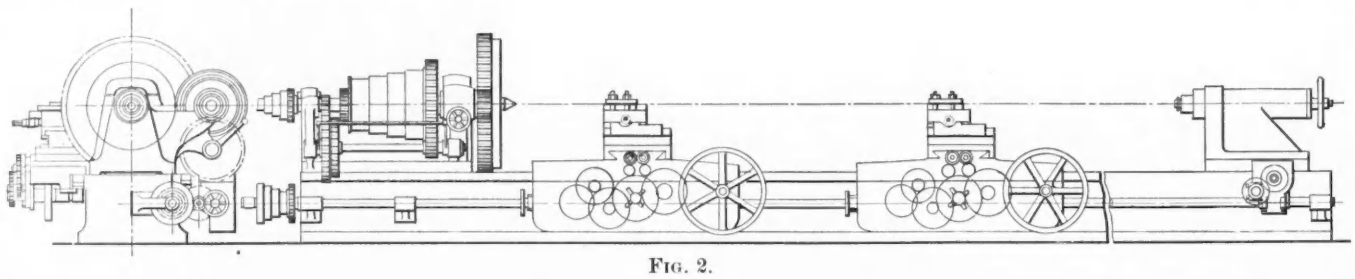


FIG. 2.

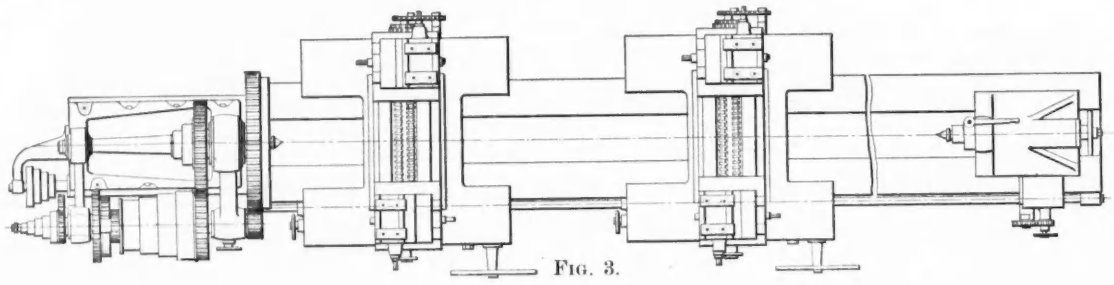


FIG. 3.

The arrangement of the driving gears is made plain by Fig. 6 (page 5), which shows a horizontal section through the main spindle boxes, and a vertical section through the cone pulley and back gear shafts.

The cone pulley is fitted to run on its shaft, and is attached to gear No. 19 by a slip bolt in the usual manner. Gear No. 18 is also fitted to run freely on the main spindle, but can be made to drive it by means of a keyed plate No. 8, to which it can be attached by a slip bolt. The back gear shaft *D* can be thrown in or out by the usual eccentrics, and the fastest speed of the lathe is obtained when gear No. 19 is connected to the pulley and gear No. 18 to plate No. 8, the shaft *D* being thrown out of action. The next slower set of speeds are obtained by making gear No. 18 loose, and driving by means of the face-plate pinion. Then by throwing shaft *D* and its gears into action, two more sets of speeds are obtained by means of the shifting gears Nos. 22 and 23. But these gears can also be used when driving by No. 18, the gear No. 19 then becoming simply an intermediate.

As will be noted, there are five thrust collars on the rear bearing, and the main bearing is without shoulders, so that it is free to adjust itself to contraction or expansion of the spindle.

There are two carriages which are each fed by means of two racks, one of which is in front and the other at the back of the lathe, so that each carriage is driven to its cut at both sides, relieving it of all tendency to cramp or twist on the bed. Fig. 4 shows the arrangement for this, the shaft *A*, *U*, which is driven by the feed gears in the front apron, runs across, and by means of other gears at the back, drives into the rack on that side. In this latter train of gears is the equalizing gear No. 79, which is so arranged that, by means of the set-screws and lugs shown, an equal strain can be put upon each rack.

This shaft also serves to drive a train of gears at the extreme rear of the carriage Nos. 82 to 86, there being two of the latter number, one on each cross-feed screw. Gear No. 83 is supported on a swing plate and stud, and provision is made for changing gears in the same manner as ordinary screw cutting gears. By this means the two cross-feed screws are driven simultaneously, and at the same rate—that rate, by means of the proper gears, being so proportioned to the carriage travel as to give any desired taper; and as one of the cross-feed screws is right-handed, and the other left, the two rests are fed in opposite directions, thus producing what may be called duplex taper turning. When driven thus from the back, both screws must be driven together. But for ordinary purposes they may be driven from the front or main feed train, and when thus driven they may both be in motion simultaneously or either one may be driven separately, at pleasure. This is effected by the arrangement shown in Fig. 5, where two swing plates are shown on the inside of the apron, each carrying a pinion which is always in engagement with the large central gear No. 68, and can be engaged with the cross-feed screw pinion by means of the crank handle, there being a handle for each plate. The plates are moved by means of the small eccentrics shown, and can be locked in or out by the clamping nuts. Motion is imparted to the feed train by the bevel pinions which are on the sleeve 61, this sleeve being splined to the feed rod and movable by means of the screw (*W*) and its hand-wheel to give motion in either direction, the pointer which projects through the apron indicating the position of the pinions.

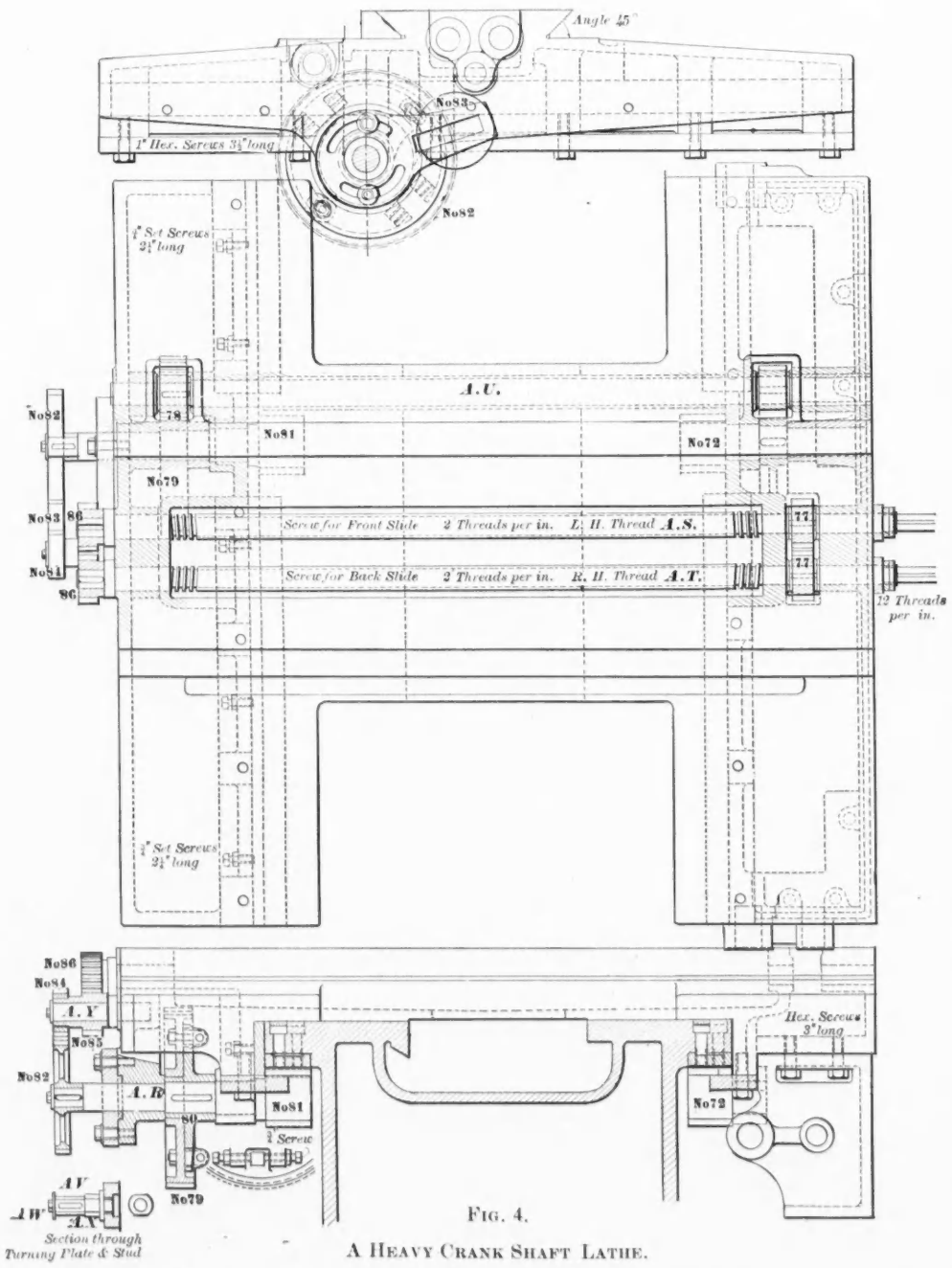


FIG. 4.

A HEAVY CRANK SHAFT LATHE.

The upper view of Fig. 5, in which the pitch lines of the various gears and pinions of the feed train are drawn, show that the motion of the feed rod is comparatively high, and the friction disk (69), which is 15″ diameter, makes four revolutions to one of the rack pinion, thus giving it ample driving power.

The saddles are 6′ in length, and the tools can be moved in any direction by hand, independently of the regular feeds, short slides being provided in the rests for that purpose.

The two rests which are at the front of the carriages are compound. To the face of the plate are attached, by means of T slots and bolts, four plates, which are movable radially, and can be clamped at any desired distance from the center, and on the face of the plate are sliding jaws moved by square-threaded screws, the jaws being faced with steel, thus forming an excellent independent four-jaw chuck.

It will be perceived that the most intelligent and painstaking care has been bestowed upon the design of this lathe, with the result of producing what must, we think, be conceded to be a very efficient tool.

All gears and the racks are machine cut. The foot-stock spindle is of steel, 6″ diameter. The total weight of the lathe is 56,000 to 58,000 lbs. It is built by Geo. Richards & Co., Broadheath (near Manchester), England.

The *Dry Goods Economist* has been getting the opinions of the owners and managers of cotton mills in the South, and these opinions appear to fortify the position taken by the *Economist*, that the building of mills was going on at a pace likely to bring investors in such enterprises to grief. The cotton being raised at the South, so soon as the idea became fixed that it should be put through the processes of manufacture there, nothing was more natural than that the building of mills should be overdone. But there are some millions of people in the United States who do not have all the cotton goods they would like, or ought to have—until they are fully supplied it is hardly a case of overproduction. What is wanted is not so much fewer cotton mills, as it is an opportunity by which those who want the product of the mills can earn the money to buy it.

The American Patent System.

By D. WALTER BROWN, PH. D.

V.

BROADENING THE CLAIMS OF PATENTS BY REISSUES.

We saw in the last article that our patent laws permit a patent to be corrected, after it has issued, by *disclaimers and reissues*, but that only those patents can be so corrected, which claim more than the inventor has a right to claim, or which do not fully and clearly describe and claim the invention.

We also saw that the reissues provided for by the letter of the law could not be used to broaden the claims of the original patent, even in those cases where the inventor was justly entitled to the broader claims.

There is, however, a class of reissues, which are not expressly authorized by the statute, but are permitted by the courts for this very purpose of broadening the claims of the original patent, so that the reissue shall protect all that the inventor has a right to.

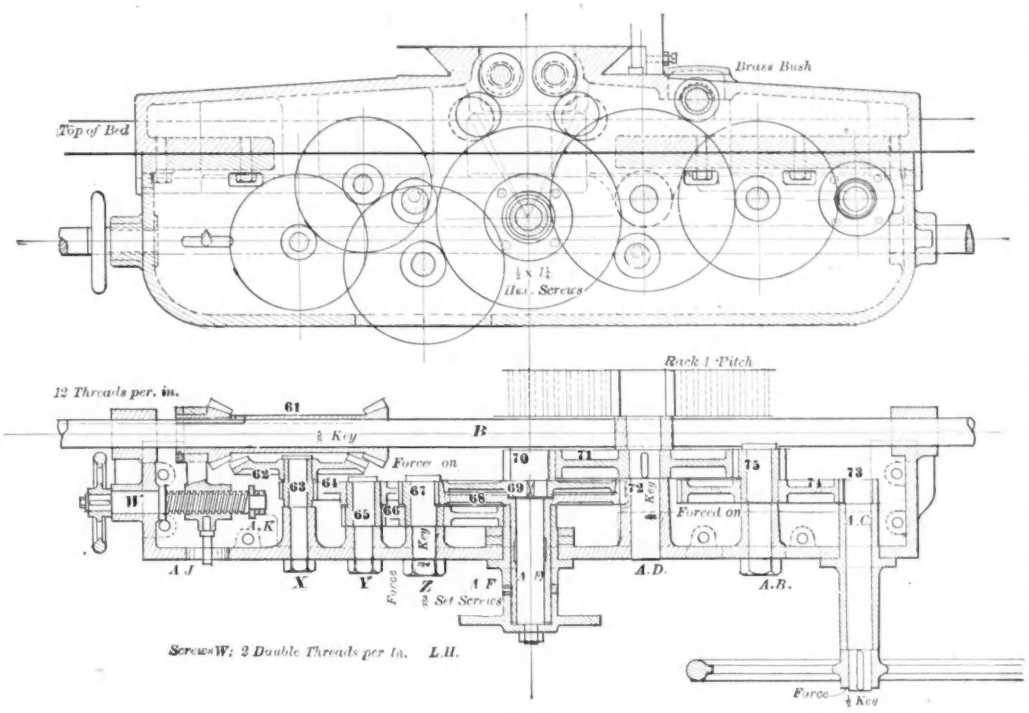
The circumstances in which this latter class of reissues are permissible have been carefully defined by the Supreme Court, and a reissue which is granted under other circumstances is void.

The conditions in which alone a valid reissue for the purpose of broadening the claims of the original patent can be granted are the following: 1st. Some genuine mistake must have been committed in drafting the specification and claims of the original patent, or during the proceedings in the Patent Office before the patent is granted; by reason of which mistake some essential thing which the inventor intended to incorporate into his original claims has been omitted from the original patent.

An example of the kind of mistake meant is this: An inventor desired to claim a certain feature in a machine, and so informed his attorney, who inserted the proper claim in the specification. But during the proceedings at the Patent Office, before the patent was granted, the claim was by some oversight dropped from the papers, and omitted from the patent. This was a case of such mistake as entitled the inventor to a reissue, which was broader than the original patent, by including a claim on a feature not claimed in the original.

The mistakes which authorize the grant of a valid reissue must be of this general type. There must be some accidental blunder, no matter by whom made, in consequence of which, something which the inventor intended to include in his description, and to claim, has been omitted from the claim, or from both description and claim.

Unless such a mistake has been committed, the Commissioner of Patents has no authority to grant a reissue with the broader claims, and if he should grant it, the reissue will be void. The existence of the mistake is the indispensable condition for the granting of the reissue. Secondly, the application for the reissue must be made as soon as possible after the grant of the original patent. Any considerable delay on the part of the inventor in applying for the reissue will deprive him of his right to the reissue, and should the Commissioner grant it after such delay, the reissue will be void.



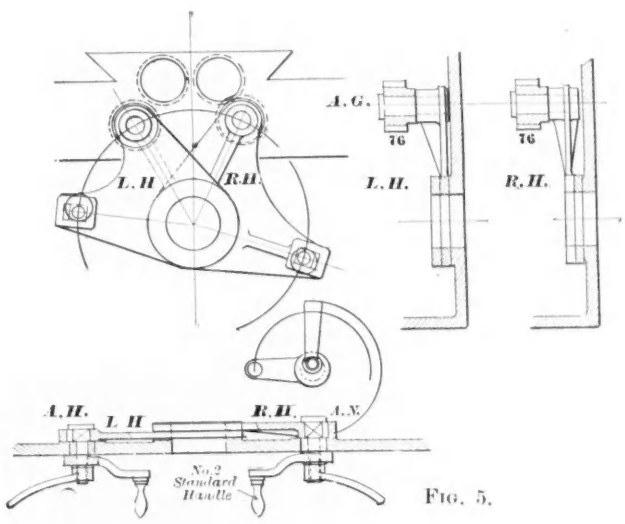


FIG. 5.

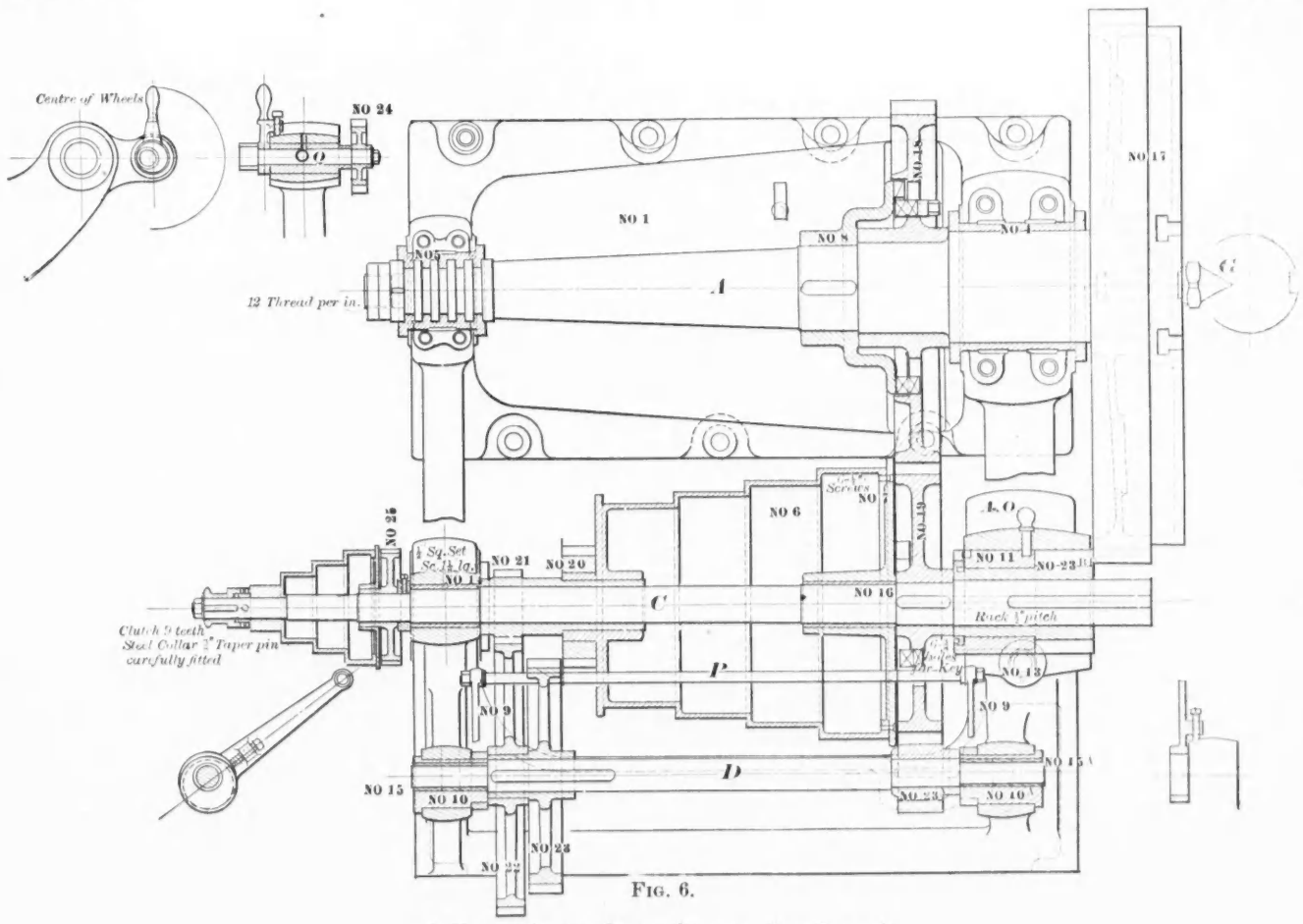


FIG. 6.

A HEAVY CRANK SHAFT LATHE.—SEE PAGE 4.

How long a time may elapse after the grant of the original patent, before the application for the reissue, is uncertain, and will depend on circumstances. If some other manufacturer has begun to make a thing like that described in the patent, before the reissue is applied for, and if that thing does not infringe the narrow claims of the original patent, but does infringe the broad claims of the reissue, then a short lapse of time will deprive the inventor of his right to the reissue. Generally a reissue cannot be granted after such manufacture has been begun by some other party, for an inventor is not permitted to obtain a reissue for the purpose of forcing a manufacturer out of business, who has begun to make a thing before the reissue was applied for.

But if no other manufacturer or inventor has begun to make similar things, then even a considerable lapse of time may not deprive the inventor of his right to a reissue; for in this case no one is injured by the reissue.

Yet, as a rule, a delay of more than two years is dangerous; for the courts will look with suspicion on a reissue granted after a greater lapse of time than two years.

When properly granted, these reissues have a very important quality. We saw in the last article that the other class of reissues, which are expressly provided for by the terms of the statute, cannot claim any substantial thing not claimed in the original patent, and that a reissue violating this restriction is void.

But those other equitable reissues are not subject to this restriction. In fact, the very reason why they are allowed is that they may include inventions which were omitted from the original patents by mistake.

Therefore, under the circumstances which I have stated above, an inventor can include in one of these reissues any substantial part of the invention which could have been included in the original patent, and which the inventor intended to so include, but which was omitted from that original patent by some accidental mistake.

The purpose of these equitable reissues is to protect the inventor from mistakes, and to secure to him the whole extent of his invention, whether it is all included in the original patent or not.

The right to take out such a reissued patent will sometimes be of immense value; for, by such a reissue, a patent originally narrower than the invention, and of little value, may be broadened up to the scope of the invention, and control a great industry.

But the granting of such reissues is most jealously restricted by the courts, and the reissue must comply with the restrictions which are now established, or it will be void.

I state again the conditions for the granting of a valid broadened reissue:

1. There must have been some blundering mistake in connection with the granting of the original patent. If there was no such mistake, the reissue will be void.

2. Application must be made for the reissue as soon as possible—before any other manufacturer has come into the field, and generally before the lapse of two years after

the granting of the original patent. Do not delay in applying for a reissue; delay may be fatal.

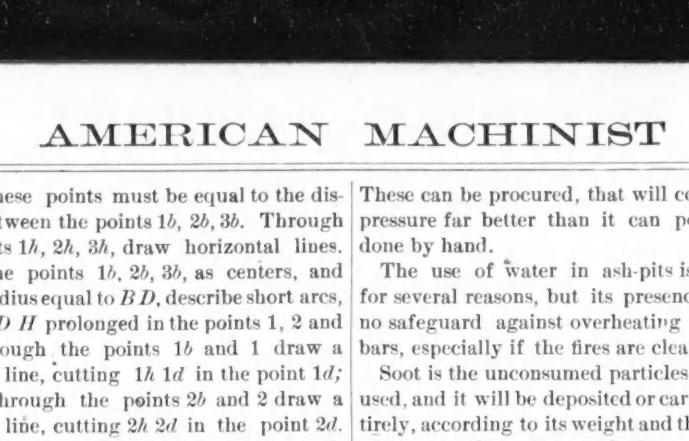
Toggle Joint.

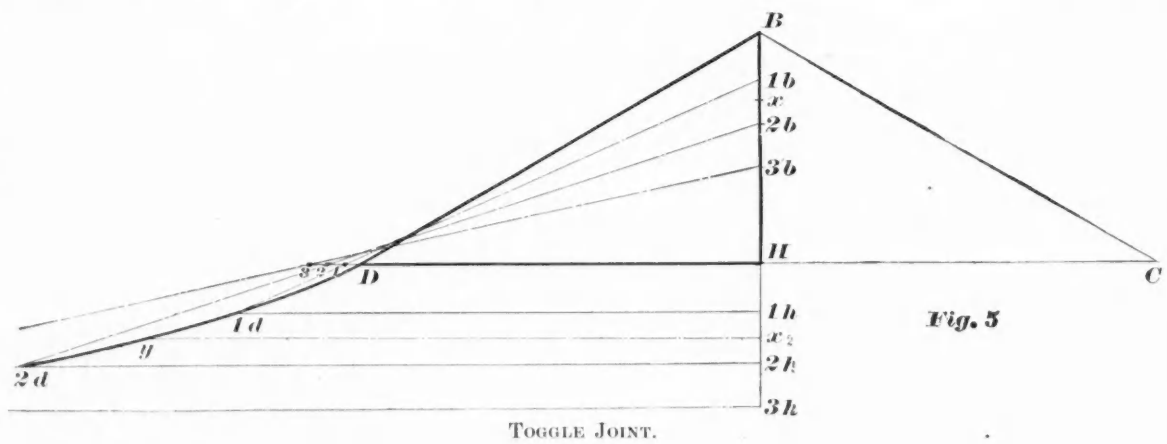
In our last issue we have taken the length $D\ B$ of the link (Fig. 1) equal to $B\ C$; let us now examine the results when $B\ C$ is longer than $D\ B$. These conditions are shown in Fig. 4, where $D_4\ B_4$ represents the length and position of the center line of the link, and $B_4\ C_4$ the length and position of the center line $B\ C$, shown in Fig. 1. For the sake of comparison we have made $D_4\ B_4$ equal to $D_2\ B_2$ in Fig. 2 (last issue), and $B_4\ H$ equal to $B_2\ e$. Now let a force of 100 pounds be applied at B_4, acting in the direction of $B\ H$; it is required to find the intensity of the force in the direction $D_4\ H$.

Fig. 3. Draw the vertical line $B_3\ d$, and make it 10 inches long; under these conditions every inch will represent 10 pounds. Through the point B_3 draw a line $D_3\ B_3$ parallel to $D_4\ B_4$ (Fig. 4); also through the point B_3 draw a line $B_3\ C_3$ parallel to $B_4\ C_4$. Through point d draw the lines $D_3\ d$ and $C_3\ d$, the former parallel to $B_3\ C_3$, and the latter parallel to $D_3\ B_3$, and thus complete the parallelogram of forces $D_3\ B_3\ C_3\ d$. Through D_3 draw the horizontal line $D_3\ e$, also through C_3 draw the horizontal $C_3\ f$; the lines $C_3\ f$ and $D_3\ e$ do not form one straight line, and consequently show a different condition of things from those shown in Fig. 2. For instance, in Fig. 3 the line $B_3\ e$ represents the vertical pressure on the point D_3, and the line $B_3\ f$ represents the vertical pressure on the point C_3; and, since $B_3\ e$ is greater than $B_3\ f$, it follows that the vertical pressure on D_3 is greater than in C_3, and the difference of pressure is as the difference of the length of the lines. In Fig. 2 the line $B_2\ e$ is equal to $e\ d$, and consequently the vertical pressures on D_2 and C_2 are equal. The sum of the vertical pressures $B_3\ e$ and $B_3\ f$ must be equal to the total vertical pressure of 100 pounds, as they are in Fig. 2, and this fact our diagram, Fig. 3, indicates, because $B_3\ f$ is equal to $e\ d$; hence the sum of $B_3\ e$ and $B_3\ f$ is equal to $B_3\ d$, which represents the total vertical pressure. The line $D_3\ e$ (Fig. 3) is equal to the line $C_3\ f$, hence the horizontal pressures on D_3 and C_3 are equal, as we might have expected. But the line $D_3\ e$ represents the intensity of the force, acting in a horizontal direction. Measuring the line $D_3\ e$ we find it to be 11.3 inches, and, since every inch represents 10 pounds, the intensity of the force $D\ e$ is $11.3 \times 10 = 113$ pounds; and this is the force which was to be found. In this example the angle $B_3\ D_3\ e$ is equal to the angle $B_2\ D_2\ e$ (Fig. 2), and the vertical force acting on B_3 is equal to the force P_0 (Fig. 2); yet the horizontal force $D_3\ e$, in Fig. 3, is greater than $D_2\ e$ in Fig. 2, and the difference is due to making $B_4\ C_4$ greater than $B_4\ D_4$ in Fig. 4.

Now let us examine the rate of change in the horizontal pressures. Let $D\ B$ and $B\ C$ (Fig 5) represent the center lines of the links, and let $B\ H$ represent the direction only of a force of 100 pounds acting downwards applied at B. In this case the angle $B\ D\ H$ is equal to $B\ C\ H$; hence, from what has been said, the line $B\ H$ must represent 50 pounds, not the whole force of 100 pounds, and the line $D\ H$ represents the horizontal pressure acting on the point D at the instant that the links occupy the position here shown. It is now required to find the intensity of the force acting in the direction $D\ H$; for any other position of the point B, the vertical force which acts on B always remains equal to 100 pounds.

On the line $B\ H$ lay off from B a number of points $1b$, $2b$, $3b$, at equal distances apart; prolong $B\ H$ downwards, and from H lay off the points $1h$, $2h$, $3h$; the distance between these points must be equal to the distance between the points $1b$, $2b$, $3b$. Through the points $1h$, $2h$, $3h$, draw horizontal lines. From the points $1b$, $2b$, $3b$, as centers, and with a radius equal to $B\ D$, describe short arcs, cutting $D\ H$ prolonged in the points 1, 2 and 3. Through the points $1b$ and 1 draw a straight line, cutting $1h\ 1d$ in the point $1d$; again, through the points $2b$ and 2 draw a straight line, cutting $2h\ 2d$ in the point $2d$. In a similar way other points can be found. Join the points D, $1d$, $2d$, etc., by a curve. The line $1h\ 1d$ terminating in the curve $D\ 2d$ and the line $H\ 3h$, represents the intensity of the force acting in the direction $D\ H$ when the point B is at $1b$; and the line $2h\ 2d$ represents the intensity of the force acting in the direction $D\ H$ when the point B is at $2b$. If the angle $B\ D\ H$ is equal to 30 degrees, and $B\ H$ is 5 inches long, then the line $D\ H$ will be 8.66 inches long; and if a force of 100 pounds acting downwards in the direction $B\ H$ is applied at B, then $B\ H$, under the condition given in the figure, represents 50 pounds, and every inch represents 10 pounds. The line $D\ H$ will represent $8.66 \times 10 = 86.6$ pounds. If the distance between B and $1b$ is one inch, and B is at $1b$, then $1h\ 1d$ will measure 11.45 inches, and the pressure exerted in the direction $D\ H$ will at that moment be $11.45 \times 10 = 114.5$ pounds. Or, if the point B moves through another inch, and is at $2b$, then the line $2h\ 2d$ will measure 15.88 inches, and the pressure exerted in the direction $D\ H$ at the moment that B is at $2b$, will be 158.8 pounds. The curve $D\ 2d$ shows that, as B is depressed the pressure in the direction increases very rapidly, and when B reaches H, the pressure becomes infinite. After the curve $D\ 2d$ has been drawn, we can readily find the pressure corresponding to any position of B. For instance, let it be required to find the pressure in the direction $D\ H$ when B has been depressed to x. Make $H\ x_2$ equal to $B\ x$; through x_2 draw a horizontal line terminating in the curve, then the length of $x_2\ y$ in inches, multiplied by the number of pounds which each inch represents, will give the intensity of the required force.





TOGGLE JOINT.

LETTERS FROM PRACTICAL MEN.

Damper Regulators.

Editor American Machinist:

Duplex asks the opinion of engineers whether it is better to use dampers or the ash-pit doors for checking the draught of boilers, himself claiming it best to use the latter. For one, I should recommend the use of a damper operated by a sensitive regulator. These can be procured, that will control the pressure far better than it can possibly be done by hand.

The use of water in ash-pits is desirable for several reasons, but its presence there is no safeguard against overheating the grate-bars, especially if the fires are clean.

Soot is the unconsumed particles of the fuel used, and it will be deposited or carried off entirely, according to its weight and the velocity of the escaping gases, and these conditions will be affected as much by closing the draught doors as the damper.

His friend should have the credit of originality, although he accomplished the wished-for result in a very unhandy and crude manner. If all the connections about the boiler were tight, as all such should be, the boiler would retain its heat as well with them and a good damper as with the arrangement described.

The scheme for packing seems feasible. It is such hints as these that go far to make good mechanical papers valuable. I for one appreciate good modern packing, having had something to do with tallowed hemp packing, not only for the rods, but for piston heads as well.

The above is given as my personal opinion, and not as one "way up"; for I am hardly in hailing distance of some of our craft.

PETER H. BULLOCK.

Controlling Draught.

Editor American Machinist:

In No. 7, Duplex advocates the use of fire doors for controlling draught, claiming that keeping the damper open in a measure reduces the deposit of soot.

When fitting up a boiler to be regulated by a damper regulator, there should be two dampers; one on the boiler, which should close tight. This should be used at night, so that no air should pass through and cool the boiler. The other should have sufficient opening so that, when closed, all the gas will have room to pass off, and none of it come out into the room. To this latter damper should be attached the regulator. With such an arrangement there will be but little more deposit of soot than if the damper were wide open.

There is not much loss of fuel from a slight deposit of soot, except the effect it has on the heating surface.

On the other hand, when the damper is open all the time, the gases, when thin, as they must be when the ash-pit doors are closed, are hurried through the boiler so rapidly that but little heat is taken up by the boiler. No one yet has been able to put up brick-work so tight that there will be no infiltration of air through it, and when the ash doors are closed, and the damper open, cold air rushes in through the holes in the furnace doors, and through any crack there may be in the walls, or around the front or side doors. All this reduces the heat of the boiler and setting, which heat must again be supplied by the coal.

If Duplex will make a careful test of running with damper wide open, and then, with his fire regulated with a good damper regulator—there are some that do not do good work, those that allow the pressure to vary 5 to 10 pounds, and those that are either wide open or shut up tight—he can tell for himself which is the better plan. Unless he makes a different record from most engineers, he will get a damper regulator.

When it comes to the effect on the boiler, there can be no two opinions, as the cold air being brought in, in all directions, cannot but help to unduly strain it.

W. E. CRANE.

Crowning Tight and Loose Pulleys.

Editor American Machinist:

Will you allow me a word in regard to your answer to Question 68? I think I am safe in saying not 10 per cent. of counters in any shop are in perfect alignment with main line, and where lack of this exists, you will notice that the belt will find the shortest distance between shafts, and if the shipper works easy—and it should—then the belt will creep one way or the other. You will have less trouble, I think, by crowning pulleys slightly. A good rule is $\frac{1}{100}$th of face of pulley, plus the constant .04 for pulleys 2″ or wider, less than 2″ make same angle or bevel as for 2″.

G. H.

Lapping Hardened Steel Bushings.

Editor American Machinist:

I send you description of a tool for lapping out holes in hardened steel bushings, etc. It works so well in my hands that I feel sure others who have such work to do will be pleased with its action. Take a piece of gas pipe of suitable size, and turn it two or three thousandths larger than the hole to be lapped. Plane a slot lengthwise three-fourths of the length of the pipe, and at the end of this slot—where it joins the solid part of pipe—cut (with a hacksaw) a transverse slot more than half way through the pipe. It will then be possible to push the bushing to be ground over the split pipe, and, by mounting same in the lathe, the elasticity of the pipe, combined with a little oil and emery, and good judgment on the part of the operator, will give more satisfactory results than can be gotten in any other way that I have tried.

This method may not be new to some of your readers. Possibly you will hear the same old story about some one having tried it hundreds of times; but as these little tricks are too often kept from publication, please be so kind as to publish this, and invite others of a like character to come out from their hiding-places.

T. R. ALMOND.

Centrifugal Pumps.

Editor American Machinist:

After reading the communication of Mr. A. H. Lefebvre in your issue of Jan. 30, it occurs to me that his experience with centrifugal pumps has been far from pleasant, brought about, no doubt, by the use of a pump that was not "made to order," nor adapted to the situation. While in the main his views are correct, yet pumps will not be constructed as he suggests and listed as standard pumps by any manufacturer, for the reason that they would cost so much that there would be little or no sale for them. I consider our market well supplied with pumps of this form, which give good satisfaction to the user. Should Mr. Lefebvre or any one else want a pump made

according to the ideas as sketched by him, it could be obtained without difficulty from any of the numerous makers. I find it is the same with centrifugal pumps as with any other machine—both good and inferior can be had, and if the customer desires something different from that illustrated by the makers in their catalogues, he can always obtain it if he pays the price. M. D. J.

"Copying Machine Designs."

Editor American Machinist:

Your editorial "Copying Machine Designs," page 8, issue of Feb. 13, '90, has been read with much interest, for the reason that we have suffered by copyists taking complicated designs, and, through inferior and low-priced labor, producing low quality of work, are able to undersell us. These remarks apply to American copyists as well as to German, whose goods are being brought into this country, and are such exact copies of our make that at first sight it is impossible to distinguish them from ours. Your closing remark, that "the only protection from copyists is in patents, in absolute secrecy, or in the utmost publicity," leads us to suggest that the "utmost publicity" be in publishing the names of the copyists, thus giving to the world the definite knowledge that certain parties are copyists. In the case of foreign imitations, we think that, if we were high tariff men, we would suggest that a tariff of 100 per cent. be laid upon all goods that are copies of American products; but public exposure by the "utmost publicity" is the only cure for American copying.

AMERICAN WATCH TOOL CO.
(By A. Webster.)

Speed of Grindstones.

Editor American Machinist:

I want everybody to tell us what they know about grindstones. For many purposes we shall always use them, whether the emery wheel is good or bad. The faster we run our grindstones the better work we will get from them. Now what we want to know is what is the highest possible safe speed for grindstones when well hung. Have been running them for twelve years. Now run seventeen. Average size, 7 inch face, and 6 feet 6 inch diameter. Change pulleys as they wear out, and aim to keep up speed of 3,000 feet per minute. Have never had an accident. Do not know whether I might run them faster or not. If so, I want to know it. Will others please tell us what they have done?

NEWELL SANDERS.

Mixture for Cores.

Editor American Machinist:

I have read with a good deal of interest, Mr. Bolland's articles on core making. I think too much praise cannot be given him for the valuable information he has given. A good core, when one has to be used, is one of the most important parts of a mould. As a rule, too little attention is given to this. In a good many foundries apprentices are set at the work of making cores, the making of which would test the skill of an expert.

I have one suggestion to make in the matter of mixtures for cores. That is that a little sawdust be added. One part of sawdust to ten of sand, for instance. I use sawdust in all my cores, and can leave a core in a mould for an indefinite time without trouble.

For very small cores I use neither flour nor molasses; I use six parts sharp sand, four parts moulding sand, and two parts sawdust.

J. R. ANDERSON.

If you are a steam engineer, don't build your hopes on anything but what you know. There is not an occupation in the world in which false pretensions will count for less. But if you are a steam engineer you want to know a good many things. An engineer who gets stuck on some simple thing that a little study would have made him solid on is unfortunate, at the least. He must back up on what he knows, but he ought to know something to lean against.

Making Steel Direct.

BY JAMES S. WILKINS, JR.

I became acquainted, during my first month's sojourn in Munich, with Prof. Theobald Boehm, the inventor of the celebrated "Boehm flute," an instrument which is a beautiful piece of mechanical skill, and which has caused a great revolution in this instrument among flute players all over the world.

The acquaintance I formed soon ripened to an intimate friendship, notwithstanding the great difference in our years, and I had the great honor of being made, to a very great extent, a confidant by Mr. Boehm. Out of this intimacy, among many other interesting events of his life, I obtained the information I now give.

Mr. Boehm was born in Munich, Bavaria, on the 9th of April, 1794, and about the same time as were Franz Leibig, Mertz, the lens maker, and Prof. Dr. Doelinger, the great reformer and leader of the old Catholic party. The latter recently died. They were all intimate friends from childhood.

Among Mr. Boehm's intimate friends was Prof. Schaffheutle, a celebrated mathematician and metallurgist, who became greatly interested in the converting of iron into steel, from the first melting, and had experimented for some years on it, until he felt he was on the road to realize the possibility; but having little money, he could not experiment on a scale extensive enough to demonstrate its practical result commercially.

Boehm lived in the same house, No. 20 Altheimer Eck, as did Schaffheutle, and being close friends and associates, Boehm, naturally, was conversant with all the ambitions and experiments of Schaffheutle.

About this time Boehm went to England to exhibit his flute, and play it in some of the great concerts. (Mr. Boehm was also a very great musician, and composer of flute music.) After various discouraging experiences, he became very popular. Among his many admirers were several amateur flutists, who were interested in the manufacture of iron and steel. With the hope of benefiting his friend Schaffheutle, he mentioned his experiments to these gentlemen, who became at once interested, and it resulted in their sending for Schaffheutle to come to London. He was there given excellent opportunities to further extend his experiments, but the result was not as successful as they had hoped for, and the parties got tired of it, and dropped the whole thing.

Boehm himself, however, got very deeply interested in the experiments, and thought with patience and persistent efforts the process could be made successful. So after considering the whole matter, and through the earnest solicitation of Schaffheutle, he joined him in the proposed further experimenting. To this end Boehm sold the English patent of his flute to Rudal & Rose, instrument makers in London, for which he got, as near as I remember, £1,500. This money he devoted to experimenting with steel. Boehm and Schaffheutle went to Sheffield, and began operations. They soon got results sufficient to assure them they would be successful. The money from the flute patent gave out, and then Boehm applied to a friend, a music publisher in London, by name of Schott, I think, who was very much interested that they succeed, and had full confidence in their ability. This gentleman advanced them, from time to time, all they needed, and, after many discouragements, but continued perseverance, they at last succeeded, and took out their patents, and protected themselves in every way.

The new invention was properly brought to the attention of steel and iron men, and resulted in the formation of a stock company who bought the patents of Boehm and Schaffheutle for £50,000, of which £15,000 was paid in cash, and the balance by notes of the company.

The new company got to work, and made steel successfully, so far as the production commercially was concerned, but some few of the large single holders of the stock desired the whole thing, and by manipulation the company was wrecked. The plant, patents, etc., were sold out, and bought up by one of the interested parties, and, by making a few changes in the converter, and so-called change in the process, which was actually no change, the party called it his process. The result was, Boehm and Schaffheutle lost the notes, and never realized a penny more out of their years of work, above the first cash payment they received. Boehm paid off all their debts of borrowed money he and Schaffheutle had made, mainly to Schott, and when they found they had lost their notes, and would recover nothing from them, they became disgusted, and returned to Munich, and there remained until they died.

Mr. Boehm ruined his eyesight by watching the melted metal while working the experiments, and ever complained of seeing a bright spot when he looked at one object.

Mr. Boehm was of a very retiring nature, a deep thinker and student, and his name was honored by all in Munich. He raised a family of nine children—eight sons and one daughter. One of his sons is, or was when I lived in Munich, superintendent of the great locomotive works at Stuttgardt, another is superintendent of the locomotive works in Munich, another was one of the directors of the Bavarian post-office department, another manager of chemical works in Augsburg, another was also connected with the post-office department at Wurzburgh. The others were all well to do.

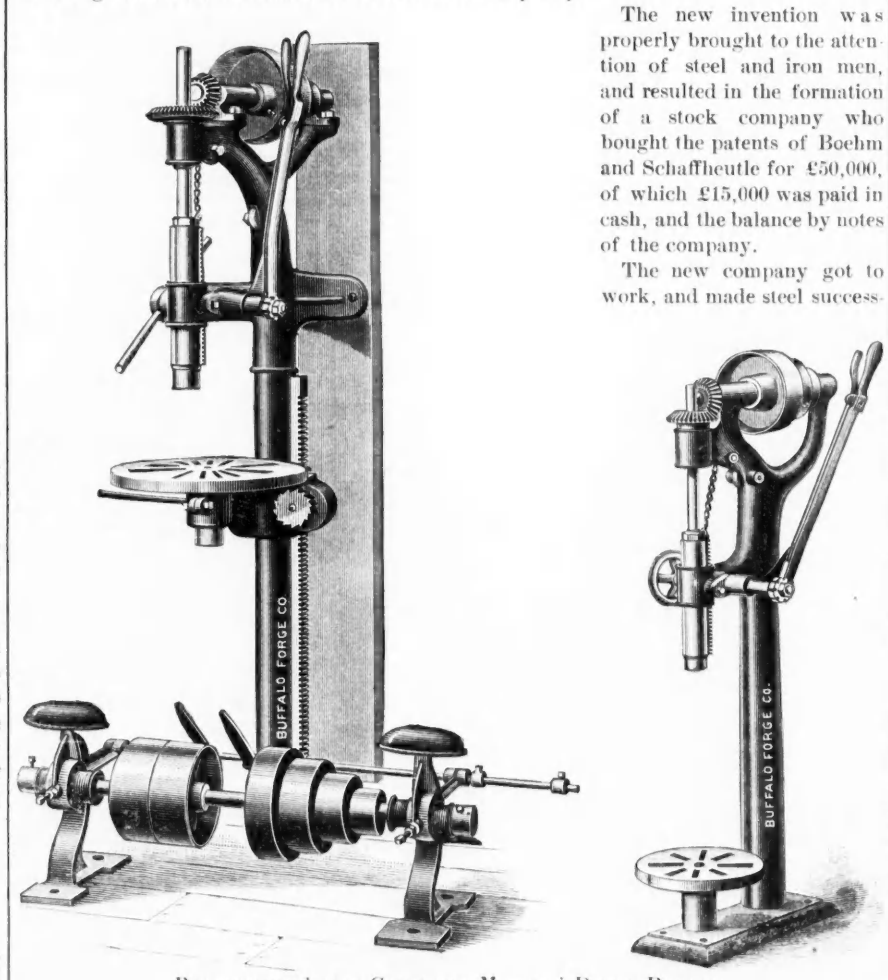
Mr. Boehm showed to me all the papers connected with this matter, and frequently spoke of it to me. He also gave me the names of the parties who deprived him and Schaffheutle of their just reward for their patents, and robbed them of the name of being the *original inventors of the present system of producing steel cheaply.* Of course they acknowledged the continual improvements sure to be made by experience, but the development of the system was certainly due to them.

Mr Boehm had copies of all their patents, and also had a special decoration for the great invention, given him by the queen.

Mr. Boehm died in 1881, I think, I never learned the exact date, but the last letter I received from him was in November, 1879.

All the papers and proofs of this invention must be in the possession of his family now, and there should be no difficulty in seeing them.

I may be incorrect in some of the minor details, but the truth of the statement and its results can be proven.



BLACKSMITHS' AND CARRIAGE MAKERS' DRILL PRESSES.

Blacksmiths' and Carriage Builders' Drill Presses.

We give with this, illustrations of two drill presses built by the Buffalo Forge Co., of Buffalo, N. Y., and specially designed for the use of blacksmiths, and carriage and wagon makers.

The cuts make their construction plain, and it is only necessary to say that pains have been taken to make them satisfactory for the purpose for which they are intended.

The gears are machine-cut; the spindles take a ¾″ Morse taper shank, and they will drill holes up to 1¼″. The larger press drills to the center of a 20″ circle, and has an attachment for supporting wheels while the tires are being drilled, which has been found to greatly facilitate the work of carriage and wagon makers.

The drill is 66″ high, and weighs 320 pounds.

The smaller machine will drill to the center of an 11″ circle, is 50″ high, and weighs 150 pounds.

Templates and gauges are used in the construction of drills and countershafts, so that all parts are interchangeable.

Tight and loose pulleys are 8″ diameter, and should run 250 revolutions per minute.

The Jersey City *Journal* is agitating the question of the small pay received for their work by women. Just as has been done a thousand times before, the *Journal* shows how insufficient the pay of shop girls is, in the majority of instances. But there is a law of supply and demand that operates here as elsewhere. What is wanted is a greater demand for labor, or fewer women who are compelled to labor.

The question of steam jackets is getting a more vexed one than ever. About the only thing that can be said about it is that in some instances the probability is that steam jacketing effects a saving, while in others it does not. But exactly what the conditions are when it may be profitably employed is not known with any degree of certainty. It is a question about which more ought to be known.

What a mistake people make, who think that the Government pays better for engineering services than private firms do. The fact is that engineers in the employ of the Government, can, if they possess good average ability, get more for their services from private firms. Government pays niggardly for the services of competent engineers, and as a result loses many of the best ones. Money brings good service.

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Mild Weather and the Miners.

It is frequently remarked that, though the present unusually mild winter has its drawbacks, it is a Godsend to the poor, who find it difficult to provide themselves with fuel and clothing sufficient to make themselves comfortable, even in moderate weather, and suffer severely during the extreme cold weather, which we naturally expect at this season.

But it seems that some one must suffer, whether it be temperate or frigid; for when mild weather partially relieves the extremely poor people of the cities from the struggle, other poor people living in the mining regions must have the severity of their struggle increased in proportion.

Owing to what is said to be the poor demand for coal, mines are shutting down, and the miners, with their families, have to suffer by reason of mild weather, which sounds paradoxical, and indeed it is a paradox, or would be, under simpler and more natural conditions of life. Many of the poor people of the cities, who find it difficult or impossible to provide themselves with the amount of coal they would like to, and really ought to consume, work in the factories, and help to carry on the various forms of industry, by which the things that miners need to make themselves comfortable and happy, are produced. The consumption of these things by the miners, on the one hand, and the consumption of coal by the other people, on the other hand, are not fixed quantities, but depend principally upon the ability of the people desiring them to pay for them, which is only another way of saying that what working people buy of the products of others depends upon the degree of their success in finding a market for their own products.

Under natural conditions, exchange would take place upon the basis of respective needs, and relative supply of the things needed; but no one can doubt for a moment that exchange would take place. Mild as the weather is, and has been, there are many thousands of families who are not using as much coal us they would like to use, and would use, if the price were lower, and they had plenty to do at good wages.

If there were nothing to prevent, these people and the miners would inevitably come together and trade products upon some mutually advantageous basis; not directly perhaps, but through the ordinary channels of trade and exchange.

Though the mild winter has lessened the demand for coal, it has not, so far as the consumer can see, reduced its price in the least; instead of this, the production is arbitrarily reduced, while prices are fully maintained. Which means simply that the poor of the cities, who never have sufficient coal anyway, regardless of the state of the weather, must give in exchange for what coal they are forced to buy, as much of the product of their labor as ever, and that, too, in a market which is depressed by the inability of miners to buy what they need.

It can scarcely be denied that this is a state of affairs that is greatly to be regretted, no matter from what standpoint it may be regarded, and one of the problems to be solved in the future—and which, let us hope, will be solved—is to so arrange things that at least men who are mutually capable by nature of producing things wanted, each by the other, may be enabled to freely work, and as freely exchange products.

A Night School for Foundry Apprentices.

We have received a letter from Valentine Geiselhart, of Albany, N. Y., giving some account of the starting of a night school and reading-room for foundry apprentices in that city. Mr. Geiselhart, who is a foundry foreman, got the boys interested in the matter, and paid the rent of a floor for one month himself. Hereafter the boys will pay ten cents a week each, and manufacturers and others interested promise to contribute, and to deliver lectures. This is the first school of the kind, so far as we know, started for foundry apprentices, and we are pleased to hear that its prospects are flattering. The daily press of Albany are saying a good word for the experiment.

There is considerable agitation in different parts of the country in relation to weekly payments for workmen. In some instances bad blood is engendered, and it is said that workmen who advocated every Saturday payment have, in some instances, been discharged. This strikes us as being an unwise proceeding. We are not entirely persuaded that, in the instance of skilled mechanics, working for good wages, there is any advantage in weekly payments as against monthly. Still, these men are the best able to judge of this. The increased cost to a manufacturer of paying weekly, will, in the instance of a large number of workmen, be considerable, but it will be very small per man. And whatever it is, the men themselves will in the end pay it. In large cities, and where men work for small wages, there is no doubt that weekly payments will enable them to get materially more for their money than they can get on longer credit. There are arguments both for and against short payments. But there is no occasion for quarrels over the matter.

One of the hopeful signs of the times is that, in England, where there has been a somewhat remarkable expansion of business during the past year, there have been so few labor troubles. Wages have been very largely increased, and the instances in which trouble has grown out of bringing about this increase have been very few, comparatively. The tendency seems to be towards a common sense view of the matter of work and wages, the workmen as well as the employer profiting by "good times." A great deal of money is spent in labor troubles that might be saved by the application of a little common sense. When trade is particularly good, nothing is more natural than that employer and employed expect to make more money out of the condition. When the share each party should have in the increased prosperity can be amicably settled upon, the better times is a blessing to all. When it is settled by a strike, all parties generally lose money. The common sense method is the best.

There is nothing like finding out things by practical experience. This seems to have been what a *World* reporter thought when he contrived to tumble overboard from an East river ferryboat to test the capacity of the crew and their appliances for saving life. According to the reporter's story, no effort was made to pick him up, and had it not been for the fact that a tug had been chartered to follow the ferryboat, the venturesome reporter would have come to grief. According to his statement the pilot did not know that a man was overboard, hence the boat kept right on as if nothing had happened. The moral of the experience of the *World's* reporter appears to be against putting trust in the life-saving appliances o. ferryboats.

In a good many States—for one, New Jersey—there are periodical attempts to pass boiler inspection and engineers' examination laws. These laws, when properly framed, ought, no doubt, to be enacted. But their advocates begin at the wrong end. The people are not educated up to the point of seeing the utility of such laws. And until they are it is impossible in the first place to pass them, and in the second place to enforce them. The proper thing is first to show the people that such laws are in their interest, then their enactment and enforcement is a very simple matter. Let engineers begin at the right end, and they will succeed.

Mayor Haynes, of Newark, N. J., has worked up a scheme that may have more in it than shows on the face. The city is to have a new water supply, and it appears that there is an unusually high head. This head the mayor proposes to utilize for driving turbine wheels for the generation of electricity, with which to illuminate the city.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(75) G. T. L., Elgin, Ont., asks: How are the different finishes on brass work, such as is used on gas and electric light fixtures, obtained? *A.*—We cannot say. The processes are partly mechanical and partly chemical, and are not made public. The only way to do such work, is to secure the services of a man acquainted with it.

(76) L. W. P., Providence, R. I., writes: Please inform me what composition metal has the greatest tensile strength, and how much is it per square inch? *A.*—Sterro-metal, a brass which contains copper 55.04, zinc 42.36, tin 0.83, iron 1.77. After simple fusion, the average breaking weight is about 60,000 pounds per inch, and, when drawn cold, the breaking weight is increased to about 84,000 pounds. 2. What metal will stand, without fracture, the greatest amount of bends? *A.*—Mild steel or Norway iron.

(77) A. B., York, Pa., writes: Can you give me some correct rule for setting the center over on a lathe for turning any given taper, say $\frac{3}{16}$ inch to the foot? *A.*—We cannot give a correct rule for this, for the reason that a complication arises from the fact that the centers enter the work an indeterminate distance. If it were not for this, an accurate rule would be: Divide the difference between the diameters of the small and large ends of the work by 2, and multiply this quotient by the ratio which the total length of the shaft bears to the tapered portion.

(78) B. B., Geneva, Ohio, writes: I would like to have an approximate statement relating to the difference in the capacity of copper and iron tubes in transmitting heat to the water. *A.*—According to some authorities, the conductivity of copper is nearly two and one-half times as great as that of iron. But it should be observed that this conductivity is for metals perfectly clean. It has been found that all metals conduct heat about alike when their surfaces become dull. Tubes soon become coated with soot, and therefore there is very little or no economy in the use of copper tubes in tubular boilers, unless they are kept perfectly clean.

(79) G. W. S., Fargo, Dakota, writes: Please give the number of square feet of radiating surface to 100 cubic feet of space for steam and hot water. I have a house, 22 by 34 feet wide, a wing, 14x16 feet; height of ceilings, 11 feet; basement about 5 feet under the whole house. *A.*—The heating surface will depend upon the construction of the house; a well-constructed house will not require as much heating surface as a cheap and poorly put up one. The windows are the most considerable item; the manner in which the house is plastered, whether on hard walls or on lath and furring, must also be taken in consideration when the heating surface is to be computed. From the foregoing you will notice that we are not in the position to answer your question correctly. Our answer to Question 297, in our issue of July 25, 1889, may aid you in making your own computations.

(80) W. F. Y., New York, writes: Will you please give the power a belt will transmit under the following conditions: The shafts are 48 feet apart, and are perpendicular. The driving pulley is 28 inches, and the driven pulley 30 inches diameter. The driving pulley runs 95 turns per minute, and the belt is 10 inches single, not extra tight? *A.*—We do not suppose you mean to say that the shafts are perpendicular, but that one is over the other, so that the belt is perpendicular. Such a belt, if horizontal, should transmit about nine horse-power. Running vertical it would not, under ordinary practical conditions, do as much, but probably about seven horse-power. So much depends upon conditions and circumstances that no definite general rule can be laid down for such matters.

(81) H. C. S., ——, writes: To utilize the power developed by a horse car in going down hill for the purpose of pulling a car up hill, I propose the following plan: A covered channel is formed between the tracks (provided the road has two tracks) having the same grade as the road. This channel forms a road-way for a small iron car, of about the average weight of a horse car. A grooved pulley is placed at the top of the hill; one end of a rope, the rope being a little longer than the hill, is fastened to the iron car; the rope is passed over the grooved pulley, and its other end attached to the horse car, making the iron car act as a counterbalance. Consequently, when a horse is ascending it is helped by the weight of the iron car. The idea struck me as being a good one, and I would like to have your opinion of it. *A.*—The idea of counterbalancing the ascent of a car is not a new one, and to your method there is this objection: The portion of the rope which is above the track will obstruct the traffic: hence it cannot be adopted in cities or busy towns. It may be used with advan-

tage in isolated places, but in such places the cars may be run up hill without stopping, and the time of running may be so arranged as to make a regular descending car counterbalance an ascending car.

(82) J., ———, writes: I wish to have your estimate of the horse-power transmitted by a heavy rubber belt, 16 inches wide, under the following conditions. A 36″ improved Rodney-Hunt turbine wheel, under a 9½-foot head, furnishes the power, and is geared to the jack shaft by miter gears 30 inches diameter. This shaft is 3⅛ inches diameter and 10 feet long, with three bearings. The belt runs from a 6-foot pulley on jack shaft, making 120 revolutions per minute onto a 4½ foot pulley on main line, which is 3⅛ inches diameter. The main line is 17 feet above, and 7 feet to one side of jack shaft, the slack side of belt being on top. The belt is stretched around the pulleys as tight as possible with screw clamps. *A.*—It is impossible to form an estimate of the power actually transmitted, because we cannot tell how much is developed by the wheel, but such a belt, under the conditions given, should be capable of transmitting about 65 horse-power, though a fair load for continuous working would be 50 horse-power.

(83) D. A. H., Brooklyn, N. Y., writes: There are two cylinders, one is 8 inches diameter, the other is 12 inches diameter; they are made of a length as to contain the same number of cubic inches. From which piston will I receive the greater force, the same amount of steam being behind each piston; of course, the steam pressure per square inch is the same in both? *A.*—Assume that the steam pressure is 100 pounds per square inch. The area of the 8-inch piston is 50.26 square inches, hence the total pressure on the piston will be $50.26 \times 100 = 5{,}026$ pounds. The area of the 12-inch piston 113.09 square inches, and the total pressure on it will be $113.09 \times 100 = 11{,}309$ pounds. Assume that the stroke of the large cylinder is one foot, then in order to give the small cylinder the same capacity its stroke will have to be $\frac{113.09}{50.26} = 2.25$ feet very nearly. The work performed during one stroke in the large cylinder is 11,309 foot-pounds, and that performed in the small cylinder, will be $5.026 \times 2.25 = 11{,}308.5$ foot-pounds. From the foregoing, we see that the total pressure or force acting on the small piston is less than that on the large one, but the work in foot-pounds is the same for both. Here we have neglected the friction, which may affect the results considerably.

(84) Pneumatics, Providence, R. I., writes: I understand that, if an air tight piston enters a cylinder which is 24 inches deep and 6 inches diameter, half way, the piston will sustain a pressure of 15 pounds to the square inch, or 424 pounds approximately. If the piston move 6 inches more, or to a depth of 18 inches, the pressure will be 30 pounds per square inch; and at a depth of 21 inches the pressure will be 60 pounds per square inch. Am I right? *A.*—Yes. 2. If a spiral spring, compressed to one-half of its normal length, exerts an elastic force of 15 pounds, will it exert double this force when compressed to half the remaining length, and so on, in the same ratio of the air in the cylinder? *A.*—No; its resistance will vary as the deflection; say, for instance, that, for a deflection of $\frac{1}{16}$ of an inch a given spring resists 15 pounds, then for total deflection of $\frac{2}{16}$ it will resist $2 \times 15 = 30$ pounds; for a total deflection of $\frac{3}{16}$ it will resist $3 \times 15 = 45$ pounds; and for every additional deflection of $\frac{1}{16}$ of an inch the resistance of the spring will increase 15 pounds. 3. I learn that 1 square inch for every 200 pounds weight is sufficient bearing for a heavy loaded shaft. Should I figure on the whole circumference of the bearing, or only on the bottom half? *A.*—On neither. You should allow 200 pounds per square inch of the projected area of the journal; the projected area is always equal to the longitudinal section of the journal made by a plane passed through the axis.

(85) T. P., Amprion, Ont., writes: 1. We wish to run a large band mill at right angles to our driving shaft. We propose to use gears, as they will suit best, if we can do it with safety and satisfaction. What is the highest safe velocity at pitch line that we could run a pair of miter gears, say 3 feet diameter—one with wooden teeth, the other iron? *A.*—You can probably run such gears at a speed of about 90 feet per second, or say 575 revolutions per minute, if they are well made and not too heavily loaded. We cannot give the name of the best authority on such matters, and we do not know that there is any one book which is best in all respects. The catalogues of the publishers of technical books will give you the titles of the leading ones, from which you must make your selection, but it is best to take several books. 2. I saw it stated recently in an article on belts that, "A tightener, when used, should be placed nearest the larger pulley, less power being required to bend the belt around it to cause the necessary adhesion." I claim that the tightener should be placed nearest to the smaller pulley; for, when a belt slips, it is always on the smaller pulley it slips first, and a tightener increases the lap of a belt on a small pulley more in proportion to the surface in contact than on a large one with a given amount of slack of belt. Which is the best practice? *A.*—Where the belt is crossed, and the arc of contact thus made about the same on each pulley, it is no more apt to slip on one than the other; but with an open belt the arc of contact is less on the smaller pulley, which makes it most liable to slip there. It is the best practice to place the tightener close to the smaller pulley, because the arc of contact is thereby increased most on the pulley which needs it most.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue.

Gear wheels and g-cutting. Grant, see adv., p 16.

Link-Belting and Sprocket Wheels.

Send for Catalogue of Link Belting.

Over 50,000,000 feet of Link-Belt in use.

Link-Belt Engineering Co., Philadelphia and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Graduating Machines. A. T. Koopman, Chicago.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

The best Upright Hammers run by belt are made by Jenkins and Lingle, Bellefonte, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Drop Presses, Punches and Shears. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor Fulton and Dutch sts., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Ice and Refrigerating Machines, 140 sold, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.

Castings for small and medium sized vertical engines. Humphrey's Foundry, Bellefontaine, Ohio.

Wrist-pin Machines. Pedrick & Ayer, Philadelphia, Pa.

Horizontal and Radial Drilling Machine. Pedrick & Ayer, Philadelphia, Pa.

Light Special Machinery and Tools to order. The Meriden Machine Tool Co., Meriden, Conn.

Whiton's Chucks. S. A. Smith, 23 S. Canal st., Chicago, Western Representative.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

For best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

For the latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal st., Chicago, Western Agent.

Patent Attorney. R. G. DuBois, 715 11th st., Washington, D. C., procures first-class patents on inventions. Valuable Hand-book on patents free.

The Sure Grip Steel Tackle Blocks must fill the bill, according to the large sales reported. See advertisement, page 13.

25″ 28″ 32″ 36″ Upright Drills a specialty. Finely made, great capacity, quickly operated, prices low. Send for list of firms using our Drills. J. E. Snyder, Worcester, Mass.

25″ 32″ 37″ 42″ "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, New Ark, N. J.

Standard Reducing Valve, Standard Pump Pressure Regulators, Improved Collignon Cylinder Oil Pumps, Jenkins Globe and Angle Valves. Send for circulars. Standard Regulator Co., Buffalo, N. Y.

Patents.—Patent soliciting of high class. D. Walter Brown, 31 Nassau st., New York. Send for "A Brief History of Patent Legislation in the United States."

Every draftsman needs one. The Engineer's Sketch Book of mechanical movements, appliances, devices, contrivances, etc., by T. W. Barber. 1,936 illustrations. 8vo. cloth, $3. Catalogue of books on mech. subjects free. E. & F. N. Spon., 12 Cortlandt st., New York.

Superintendents of industrial establishments will find the *Engineering and Building Record*, published weekly at 277 Pearl st., New York, useful. Municipal and building engineering problems a prominent feature. Specimen Copy, 10 cents.

De Lamater Screw Propeller Wheel made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Stub Ends and Connecting Rods for small connections. Especially adapted for Valve Rod for Steam Engines. T. C. Dill Machine Co., Philadelphia, Pa.

H. B. Roelker, 22 Cortlandt St., New York, late Sup't De Lamater Iron Works, will hereafter manufacture the De Lamater Screw Propeller. Propellers of same pattern and workmanship as formerly made by the De Lamater Iron Works. Each designed for its special work at lowest prices. Consulting Expert and Constructing Engineer. Estimates made on machinery and on damages.

Just concluded. "Practical Drawing." By J. G. A. Meyer. Copies of the American Machinist containing the above series of 93 articles sent by mail to any address in the U. S., Canada or Mexico, for $4.65, or single copies 5 cents each. American Machinist Publishing Co., 96 Fulton st., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the American Machinist. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton st., New York.

Just concluded. "Modern Locomotive Construction." By J. G. A Meyer. The above series of 106 articles, which have attracted so much attention everywhere, is now concluded in newspaper form. Copies of the American Machinist containing the entire set sent by mail to any address in the U. S., Canada or Mexico for $5.30, or single copies 5 cents each. American Machinist Publishing Co., 96 Fulton st., New York.

MANUFACTURES

It is proposed to build a large hosiery mill at Meredith, N. H.

The erection of a woolen mill is being agitated at Newport, Maine.

The Diamond Wrench Co. expect to build a factory, 80x200 feet, at Portland, Maine.

Daniel E. Paris, of Troy, N. Y., will build a stove foundry at Leeds, Ia., to employ 400 men.

The Standard Foundry Company, St. Louis, Mo. is about to increase its capital stock to $75,000.

The Bangor Edge Tool Company, Bangor, Maine, will overhaul its motive plant and make other changes.

The Morgan Engineering Works, Alliance, Ohio, is building a steam hammer that weighs, with the block, 860 tons.

The Middlesex Electric Light Company, of Lowell, has voted to increase its capital stock from $150,000 to $300,000.

The Almy Water Tube Boiler Company, of Providence, R. I., is introducing a new and improved water tube boiler.

A company with which C. H. Culver is connected has been organized at Akron, Ohio, for manufacturing ice-making machinery.

The Litchfield Car Company, Litchfield, Ill., is building 2,000 box cars for the Cleveland, Cincinnati, Chicago & St. Louis Railroad.

S. T. Williams, of Wheeling, W. Va., having been granted a $10,000 bonus, will erect a rolling mill at Muskegon, Mich., to cost $90,000.

The Hanley & Keraghan Plumbing, Gas Fitting and Heating Company, of Kansas City, Mo., has filed articles of association at Jefferson City.

The Babcock Printing Press Manufacturing Company, New London, Conn., has issued a neatly printed and illustrated catalogue of their products.

An English syndicate contemplates purchasing the 30,000 acres of iron lands belonging to the Knoxville Car Wheel Co., on Stony Creek, Tenn., for the purpose of manufacturing Bessemer steel.

The stockholders of the Eastford Jewelry Manufacturing Corporation at Putnam, Ct., have perfected their organization, and voted to purchase the Arnold Bros. plant, including several buildings and a fine water privilege.

The St. Louis Steel Foundry Company has been incorporated at East St. Louis, Ill., to do a general manufacturing business. Capital stock, $75,000. Incorporators, Thomas Howard, Edward F. Goltra and John W. Harrison.

The Sinclair-Scott Manufacturing Company has been incorporated at Baltimore, Md., by William G. Atkinson, J. Baker, K. Harrison, and others, to manufacture agricultural implements and machinery. Capital stock, $60,000.

The Union Foundry and Machine Company, of Pittsburgh, Pa., with a capital of $25,000, was granted a charter, at Harrisburg, Monday. The directors are James M. Bailey and W. Friend, of Pittsburgh, and Frank H. Zimmers, of Allegheny.

The National Forge and Iron Company has nearly completed its forge department at East Chicago, and it expects to soon put it in operation, and begin work on contracts for car axles and forgings. The rolling mill is working to its full capacity.

The Gas and Gasolene Engine and Motor Company, of which Louis Wahl, of Chicago, is president, has bought the Dr. Gillet farm, which is in the city limits of Aurora, Ill., and decided to locate its manufacturing plant there. The company will erect shops in the spring.

The Dickson Car Wheel Company, Houston, Tex., is enlarging its plant, and will increase its capacity from 1,300 car wheels to 1,900 per month, workmen being now engaged in putting in two new floors. Other important improvements are contemplated in the near future.

Gresham, Linnell & Co., of Charlotte, N. C., have purchased the Montour Cotton Mill at Sparta, Ga., and will put it in operation. The mill has not been run since 1877, and contains 5,120 spindles, being formerly run on sheetings, shirtings, yarns and robes. New cotton machinery will be purchased.

The Bryant Nail Company, recently burned out at Lynn, Mass., are considering the matter of locating in Montpelier, Vt., which exempts all new manufactories from taxation for ten years. It is said that the company will locate there if $40,000 worth of stock is taken by residents. The capital is $250,000.

Henry R. Worthington, New York, has issued a new and very complete general catalogue of pumping engines, steam pumps and hydraulic machinery It contains illustrations of a great number of engines and pumps for almost every purpose. The catalogue will be of value to any engineer as a book of reference.

What is said to be the largest street car and omnibus factory in the world, located at Parker, Minn., is nearly completed. The intentions are to add a freight car manufacturing plant, which, taken together, will give employment to 1,000 men. The factory buildings cover 36,000 square feet, and five cars a day can be turned out.

The Quincy Pontoon Bridge Company has been incorporated at Quincy, Ill., by S. N. Stewart, T. A. Anderson and J. N. Spriggs. The company proposes to build a pontoon bridge across the Mississippi river. The capital stock is $50,000.

The Colorado Coal and Iron Co. contemplates erecting two new blast furnaces at Pueblo, Col. The steel rail plant will materially increase the revenue of the company; inquiries already made indicate that the output can be readily sold to Colorado roads. The company, it is claimed, has the raw material on its own property to make steel rails.

We recently noted the fact that J. Fred Harris & Co. had started in the business of manufacturing small machine tools at Binghamton, N. Y. A note from the Lodge & Davis Machine Tool Co., Cincinnati, Ohio, says that the Binghampton Company will build 12″ and 14″ lathes, and that the entire product will be controlled and put on the market by the Lodge & Davis Machine Tool Co.

A deal was perfected in Pittsburgh, last week, by which the control of the edge-tool trade of the United States was monopolized and parceled out among different concerns. The American Axe Company, a new Pittsburgh corporation, is composed of a syndicate comprising, with one or two exceptions, all the concerns in the United States making edge tools of the character of axes.

The Oshkosh Iron Pump Works and Brass Foundry, capitalized at $100,000, and working, in the beginning, fifty skilled workmen, have signed articles of agreement, by which the works are to be removed from Oshkosh to Kokomo, Ind., as soon as buildings can be erected. Work will begin at once. The main building will be of brick, stone and iron, 50x200 feet, together with finishing rooms, offices, etc. The works include a large brass and iron foundry.

The Beverly Electric Light Co., of Beverly, Mass., intends to tear down its present wooden station, and erect a substantial brick structure, with a capacity for future needs. One reason for the increase in capacity is for electric motor work, which is rapidly increasing. The company is rapidly pushing forward its new alternating 650 light alternating system. The machine is one of the largest, and includes all of the modern improved apparatus. An additional arc light dynamo is soon to be installed.

After being idle for nearly three months, the Adriatic Woolen Mills, at South Worcester, Mass., have resumed operations. The company formed has a capital stock of $90,000, and will be known as the Worcester Woolen Mill Co. The corporators are: E. D. Thayer, Jr., president; C. J. Little, treasurer; J. Legg, and W. B. Fay. Thirteen sets of machinery will be started at once, and employment given to about 200 hands. It is said that the mill originally cost $200,000, but was bid in by the creditors for a little over $63,000.

A press dispatch from Hamilton, Ohio, says: The Niles Tool Works, of Hamilton, have finished, and are now loading an immense armor-plate bending roll that is to be sent to the navy yard at Mare Island, San Francisco. The tremendous machine weighs, in round numbers, 400,000 pounds, and the freight will be something over $10,000. The Cincinnati, Hamilton & Dayton has had a number of special flat cars built for the transportion of the load, and the whole train will be run through to the coast as a special. It is the largest single shipment and the finest machine that ever left Hamilton—a town where some magnificent machinery is built.

The new foundry of the Westinghouse Air-brake Company, at Wilmerding, Pa, is to be run on the continuous moulding plan. The company has purchased the sole right of using this process in the United States from the patentees, Alley & McClellan, of Glasgow, Scotland. By this process casting is going on all the time. When finished, the moulds are placed on trucks, which run on rails to the cupola, where the moulten metal is poured in. They are then propelled on to the casting house, where the moulds are dumped out and sent back to the moulding-room to be remodeled. The sand that is dumped out is conveyed back to the moulding-floor by a belt having little "scoops," in the manner grain is taken up into elevators. The pig metal and other articles used in charging the cupolas, will be taken up on an elevator railway. Every appliance for saving labor and expense possible, has been made use of. The foundry is expected to be in operation by April 1.—*Pittsburgh Commercial Gazette.*

The Aerated Fuel Company, Springfield, Mass., has made arrangements with the Gilbert & Barker Manufacturing Company, of the same city, whereby the last named company assumes the general agency for the United States for the manufacture and sale of the fuel oil burners of the Aerated Fuel Company. This company makes the following announcement: We take pleasure in announcing that we have appointed the Gilbert & Barker Manufacturing Company our general agents for the United States. Their twenty-five years' experience in the use of gas, both for lighting and for fuel purposes, qualifies them to install our system of burning oil in the most reliable and perfect manner. They have a corps of able assistants, who are thoroughly posted in all that pertains to the use of hydro-carbon for fuel. They are so thoroughly equipped that piping, air compressors, oil pumps, tankage and oil can be furnished at the shortest notice, and in the best possible manner. They will make your interests their own, and will render you prompt and satisfactory service in every particular.

Machinists' Supplies and Iron.

NEW YORK, Feb. 21, 1890.

Iron—American Pig.—The general condition of the market is about the same as reported last week. Little new business has been transacted during the week, but furnace men seem not to be inclined to make any further concessions. We quote standard brands No. 1 X Foundry, $19.50 to $20; No. 2, $18.50 to $19; Grey Forge, $17.50 to $18.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

A mechanical draftsman and designer with practical exp. wants position. Box 88, AM. MACHINIST.

Mechanical draftsman wants a situation. D. A., care AMERICAN MACHINIST.

Wanted—Machinist familiar with W. & G. construction. Give refs. and wages. Box 118, Yonkers, N.Y.

Mechanical draftsman, thoroughly competent in machine and engine designing, desires position in vicinity of New York. Box 86, AM. MACHINIST.

Wanted—Competent machine shop foreman wants a change. Can turn out first-class work at lowest cost. Address W.C.M., AMERICAN MACHINIST.

Wanted—A permanent position as sup't, ass't sup't or head draftsman, by an energetic young man who held such office before. Great exprerience; the best scientific training. "Steady," AM. MACHINIST.

Wanted—A few young machinists who have had some experience, on small tools. Men with gumption, competent to swing piece-work. Mosely & Co., Elgin, Ill.

Wanted—A 1st-class machinist to take charge of a plant of special tools for the manufacture of a steam engine regulator. Must be energetic and reliable. Gisholt Machine Co., Madison, Wis.

Wanted—A few 1st-class machinists to learn to use our improved turret lathes. Will guarantee good pay and steady positions to active, reliable men. Gisholt Machine Co., Madison, Wis.

Wanted—A 1st-class man as sup't of a general foundry and machine works. To a live, energetic and thorough man, liberal inducements will be offered. Address Excelsior, AMERICAN MACHINIST.

Wanted—Reliable 1st-class machinist, capable of getting out work and handling men. Steady work, good wages to the right man. Address, stating work accustomed to, wages wanted, etc., Box 91, AM. MACH.

Wanted—Position as sup't or manager of light mfg. concern by a practical mechanic and thorough business man. Would join responsible party in partnership. Eastern, care AMERICAN MACHINIST.

Wanted—A machine shop foreman. Must be a good organizer, and competent to handle 50 men to best advantage; principally on heavy work, such as sugar machinery. Box 90, AMERICAN MACHINIST.

A thoroughly practical man wants position as traveling salesman or branch manager for some 1st-class manufacturer of machine tools or gen'l mach'y. 10 years' exp., thoroughly posted, and can sell goods, contract and construct. "Salesman," AM. MACH.

Machinist and tool maker would like position as foreman of shop or dep't of factory where special machines and tools are made. At present holding such a position, but, for good reasons, wishes to make a change. Refs. Box 92, AM. MACHINIST.

Correspondent and salesman wanted by a large manufacturing company near New York City. A gentleman of education, and of good mechanical and commercial experience, to conduct correspondence relating to engineering and other products. Address, stating age, experience, references, and salary required, Box 85, AMERICAN MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Cheap 2d h'd Lathes & Drills. S. M. York, Clev'd, O.

Graduating Machines. A. T. Koopman, Chicago.

Just out; aluminum-steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, Ohio.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, O.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Turned and Highly Polished Iron and Steel Shafting a specialty. Merwin McKaig, Cumberland, Md.

Complete list of our Scales and other new tools for 2c. stamp. A. T. Koopman, Chicago.

Castings of every description and machinery built. Address Cedar Point Foundry, Port Henry, N. Y.

For Sale—One heavy Hewes & Phillips Planer, 32"x32"x8 ft., in good order and repair. Address Capitol Mfg. Co., Chicago, Ill.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

Simonsen-Walter Mfg. Co., Jefferson City, Mo., with modern foundry, machine and wood-work plant, wants spec. to manuf. for Western trade.

For Sale—Half interest in machine shop and foundry doing a paying business in a good town, can be bought cheap. Address Box 89, AM. MACHINIST.

Wanted—To buy second-hand lathes, planers and shapers of all sizes; must be cheap and in good order. Fosdick & Plucker, 6th and Culvert Streets, Cincinnati, O.

How to remove and prevent scale in steam boilers at a cost of ten cents a week. Send postal for circular to Pittsburgh Boiler Scale Resolvent Co., Pittsburgh, Pa.

For Sale—New, A Brown & Sharpe No. 2 Tapping Machine, originally purchased as a spare machine, and never used. Tail rest is adjustable. Tap reverses automatically, and is backed out at quick speed. Drives taps up to 3-4". Inquire of the Neverslip Horseshoe Co., 36 India Wharf, Boston.

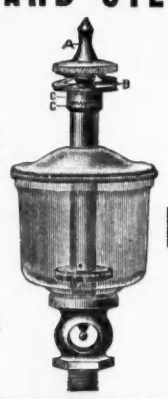
BRADLEY HAMMERS AND FORGES.
The BEST HAMMERS in the WORLD RUN BY BELT.
Over 1500 In Use.
Three Styles, 15 lb. to 500 lb. Heads.
Our FORGES heat irons fast enough to keep Hammers and men fully employed.
Send for Catalogue and Prices.
BRADLEY & COMPANY, Syracuse, N. Y.
63 Murray St., NEW YORK. 99 Sudbury St., BOSTON.

AN IMPORTANT PRACTICAL WORK
Railroad Engineers' Field-Book and Explorers' Guide.—Specially adapted to the use of Rail road Engineers on Location and Construction, and to the needs of the Explorer in making Exploratory Surveys. By H. C. Godwin. Morocco flaps, $2.50.
JOHN WILEY & SONS, 53 E. 10th Street,
(2 Doors West of Broadway, N. Y. City.)

"Star" Foot Lathe Swings 9x25 in.
LATHE
Screw Cutting Automatic Cross Feed, etc.
Scroll Saws, Circular Saws, Lathes Mortisers.
Catalogue Free of all our Machinery
Seneca Falls Mfg. Co., 687 Water St., Seneca Falls, N. Y.

WILLIAM JESSOP & SONS, L'D.
MANUFACTORY, SHEFFIELD, ENGLAND. | Chief American Office, 91 JOHN ST., NEW YORK.
JESSOP'S BEST TOOL STEEL
Gold Medal, Paris, 1889.
Steel in Stock. Importation Orders Promptly filled. ALL KINDS OF

TO ENGINEERS & FIREMEN.
ROPER'S
PRACTICAL HAND BOOKS,
BY STEPHEN ROPER, Engineer.
These books embrace all branches of Steam Engineering—Stationary, Locomotive, Fire and Marine. Any engineer or fireman who wishes to be well informed in all the duties of his calling should provide himself with a full set. They are the only books of the kind ever published in this country, and they are so plain that any engineer or fireman that can read can easily understand them. For sale by all Booksellers.
Send for Descriptive Catalogue, FREE to any ADDRESS.
EDWARD MEEKS,
PUBLISHER,
No. 1012 Walnut St., Philadelphia, Pa.

STANDARD OIL CUPS.
FOR ENGINES & DYNAMOS. HIGH SPEED MACHINERY.

A. J. WILKINSON & CO.,
184 Washington Street,
BOSTON, MASS.

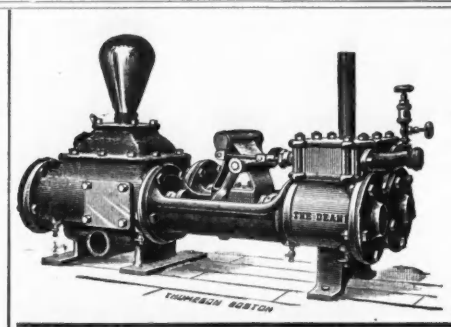
SEND FOR CATALOGUE.
WORCESTER MACHINE SCREW CO.

Manufacturers of Set, Cap & Machine Screws, Studs, etc.

PATENTS THOMAS P. SIMPSON, Washington, D. C. No atty's fee until Patent obtained. Write for Inventor's Guide.

GEO. F. BLAKE MANF'G CO.
BUILDERS OF EVERY VARIETY OF

95 & 97 LIBERTY ST., NEW YORK. 111 FEDERAL ST., BOSTON.
WATER WORKS PUMPING ENGINES A SPECIALTY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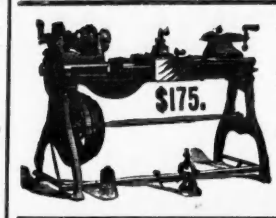

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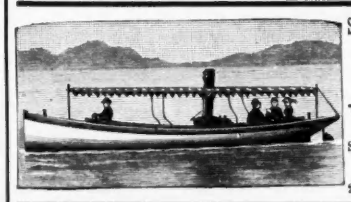
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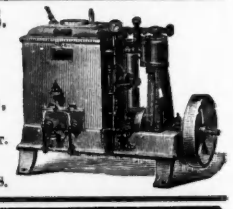

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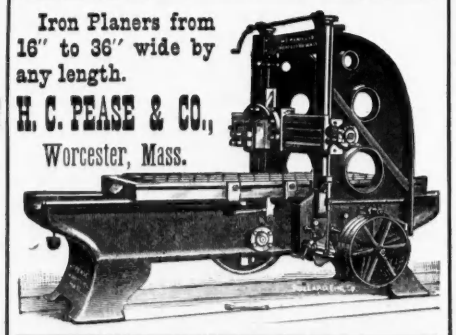

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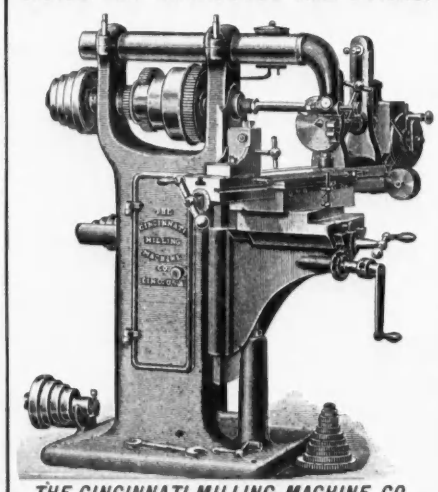
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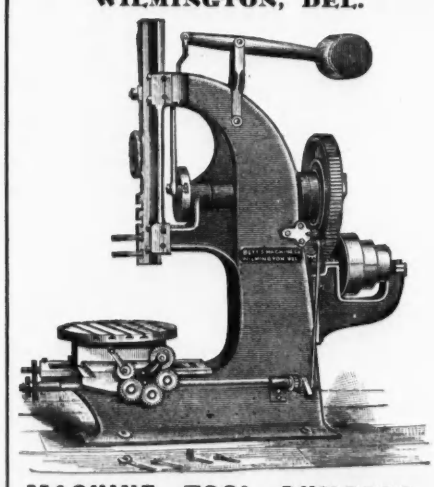
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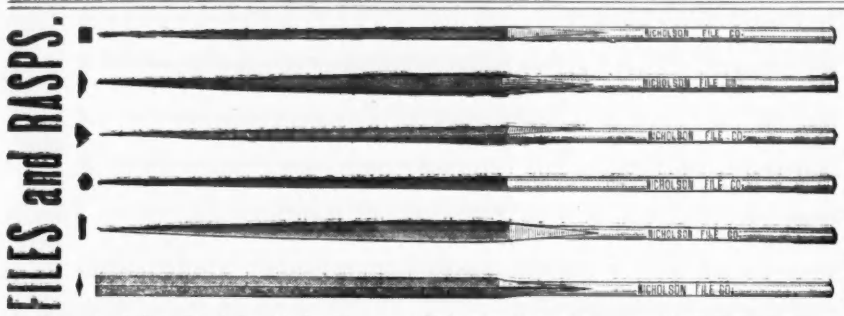

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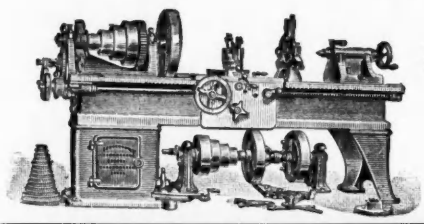
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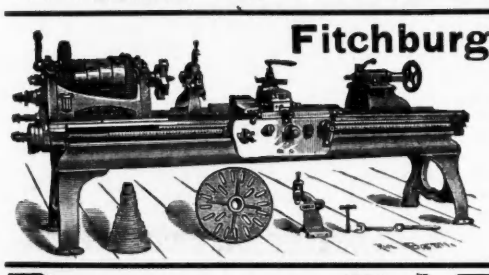
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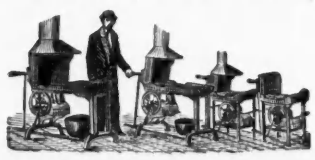
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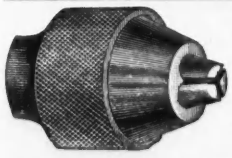
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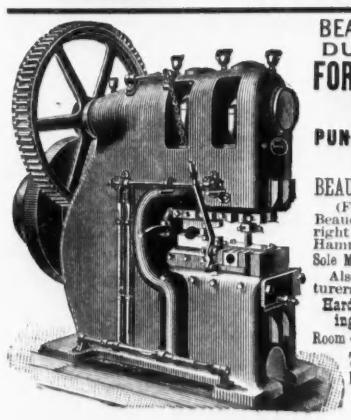
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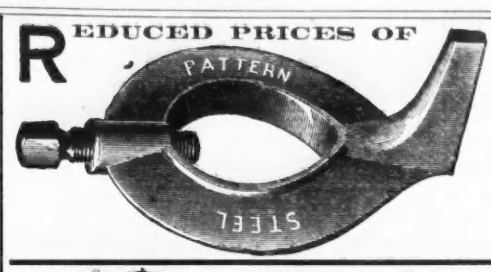

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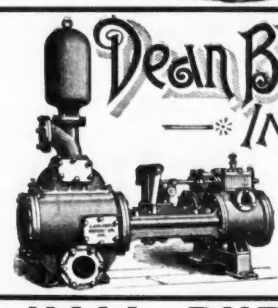
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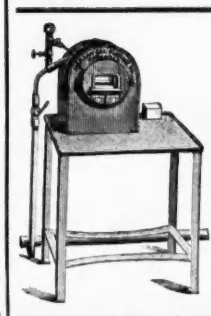
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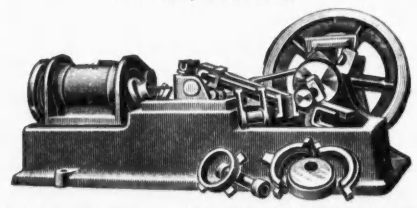
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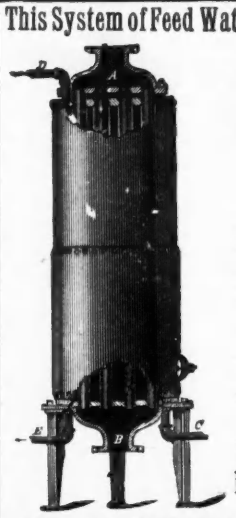

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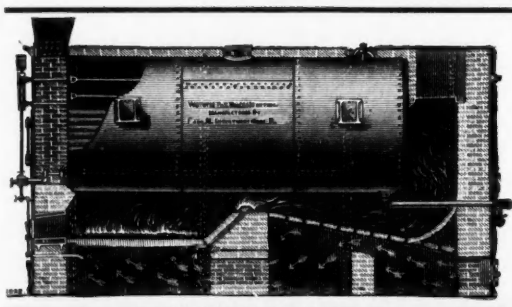

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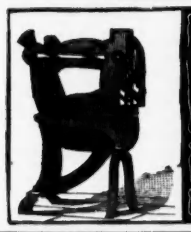

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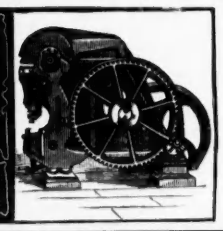

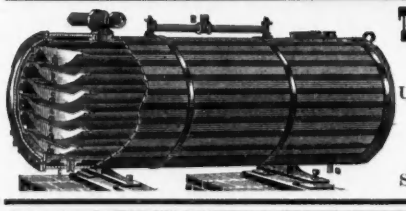

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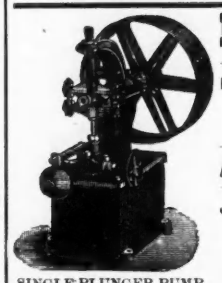

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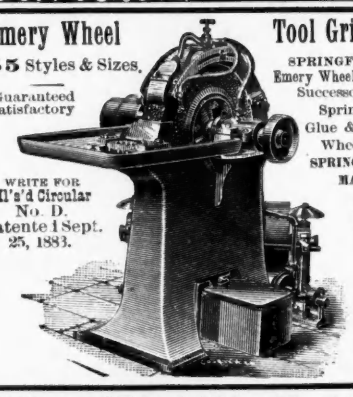

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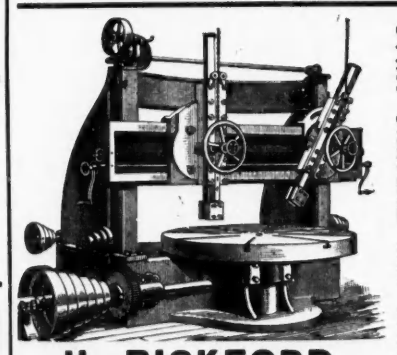

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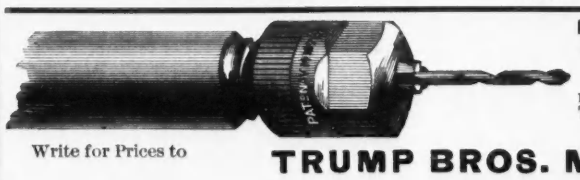

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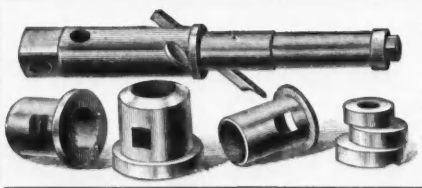

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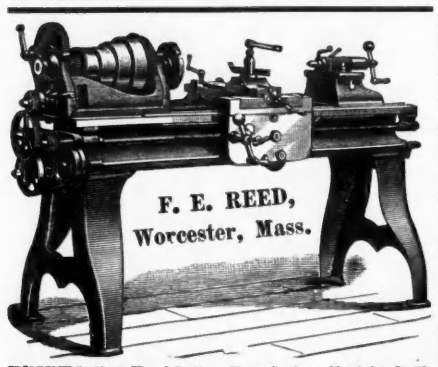

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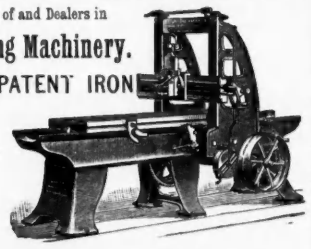

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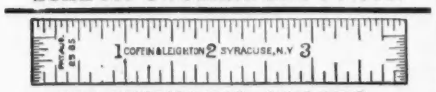

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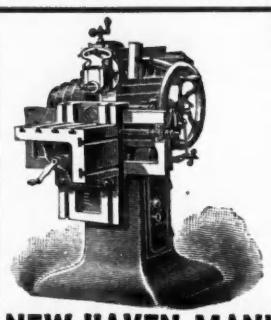

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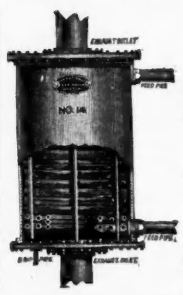

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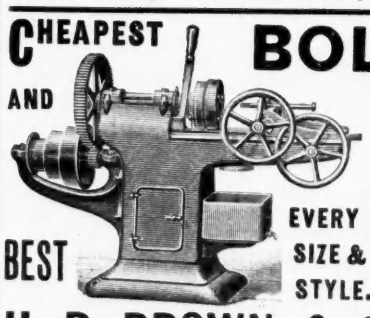

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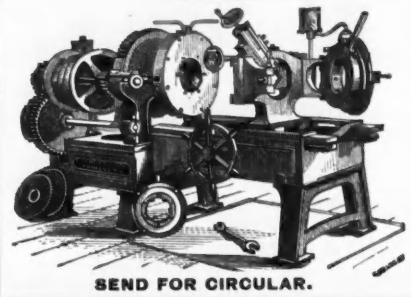

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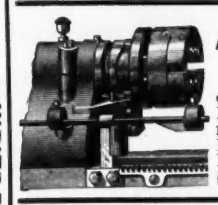

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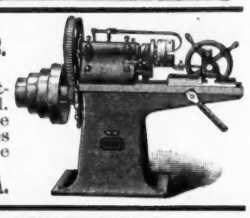

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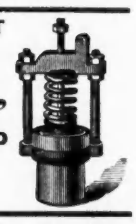

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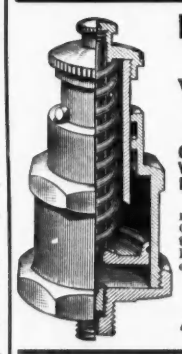

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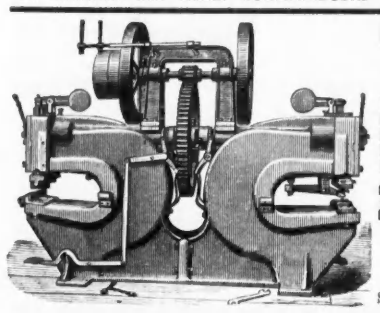

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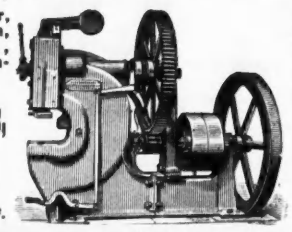

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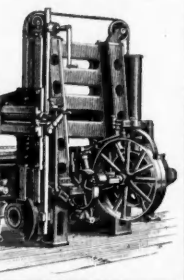

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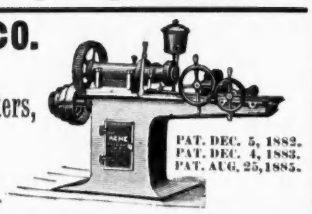

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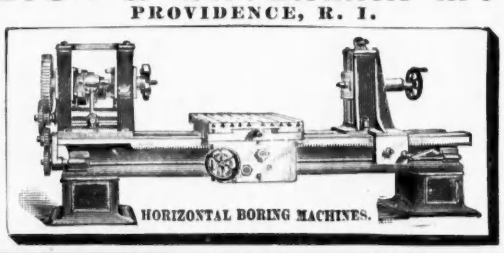
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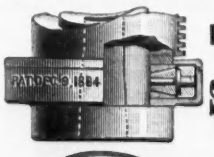

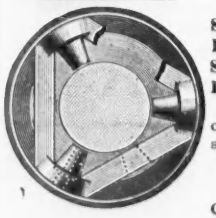

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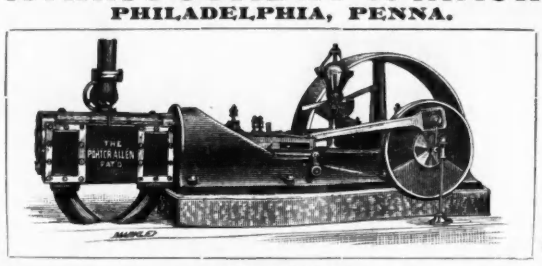

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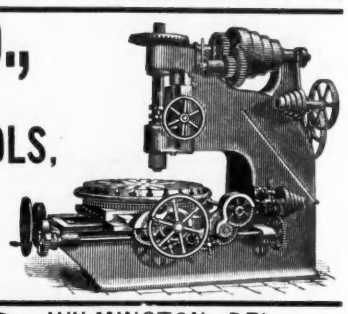

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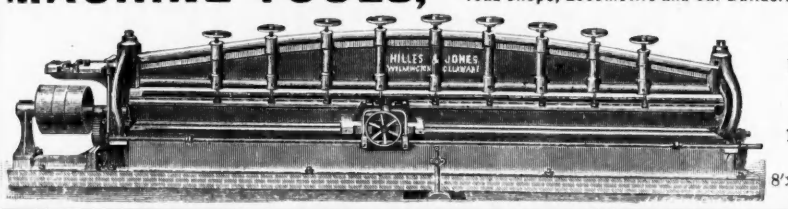

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SMOOTH INSIDE & OUT.
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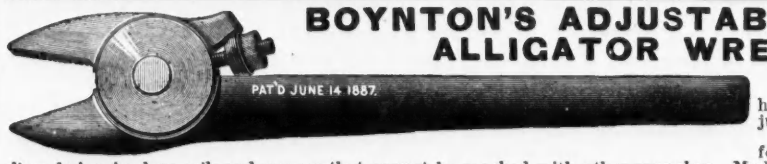

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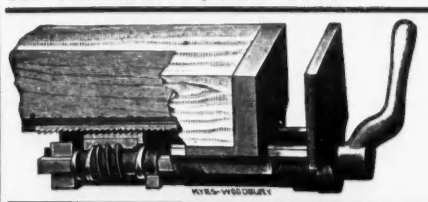

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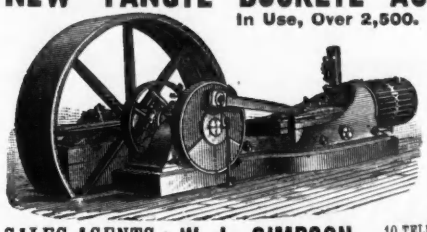

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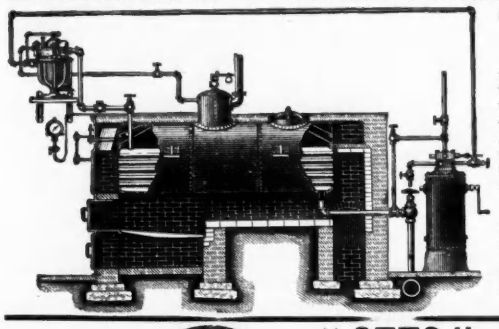

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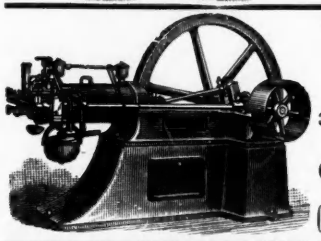

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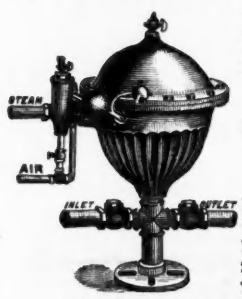

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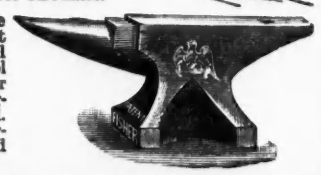

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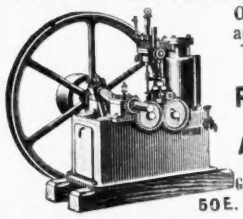

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☞ An inexperienced boy can handle the Lathe.

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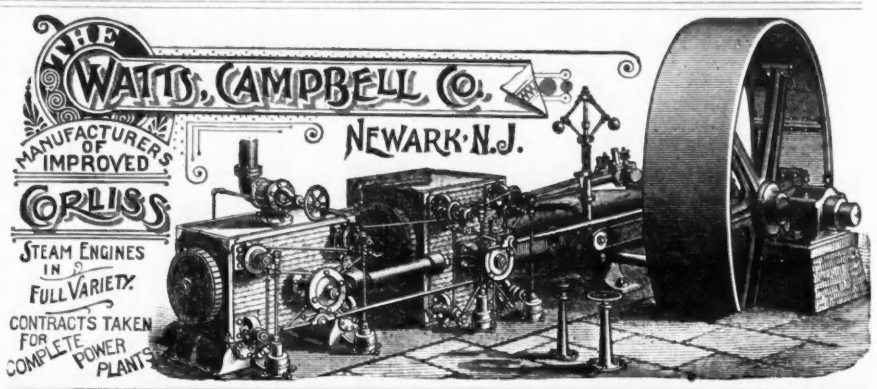

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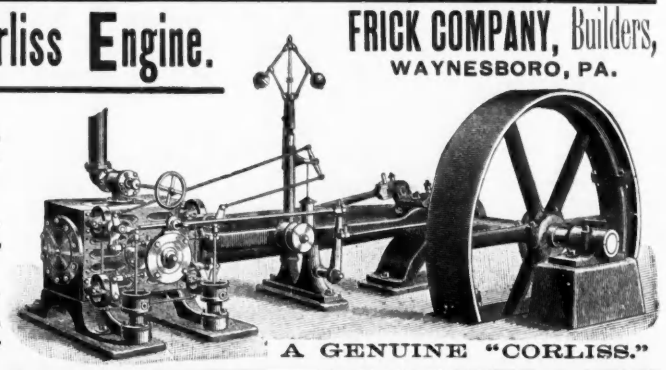

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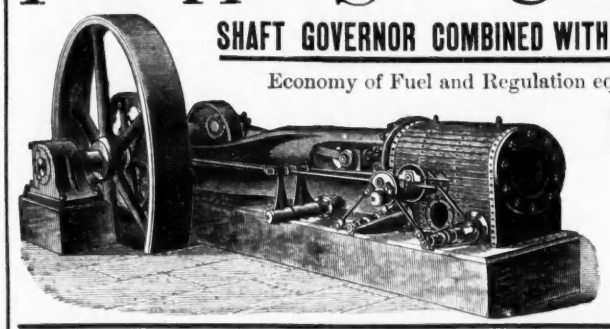

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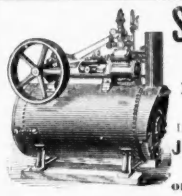

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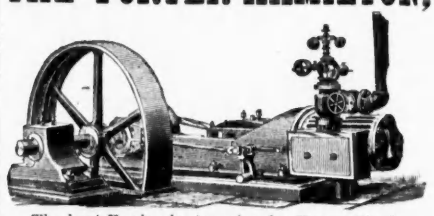

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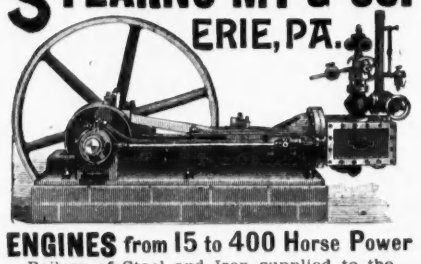

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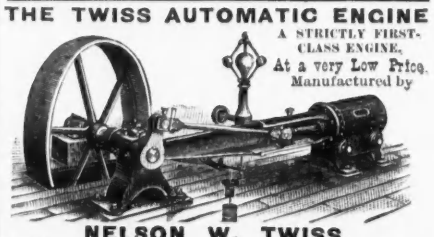

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For Separating and Removing Entrained Water from Live Steam;

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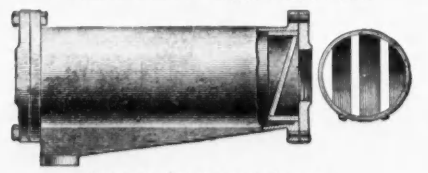

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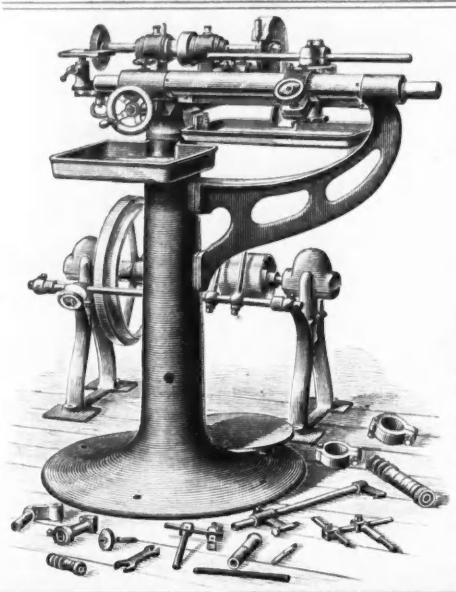

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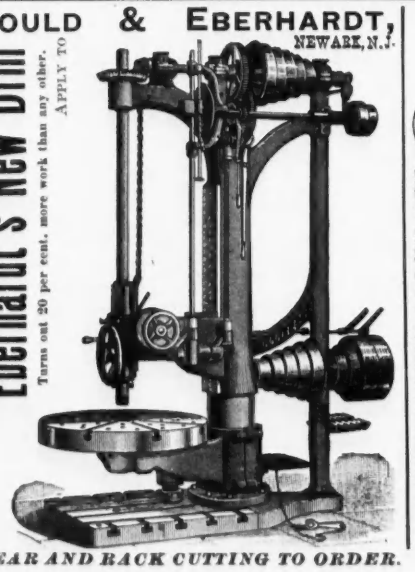

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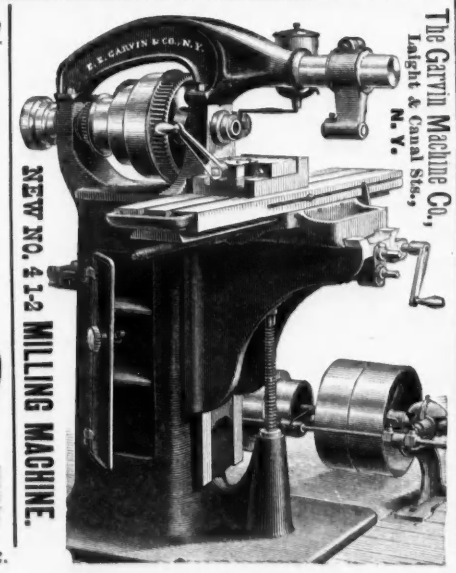

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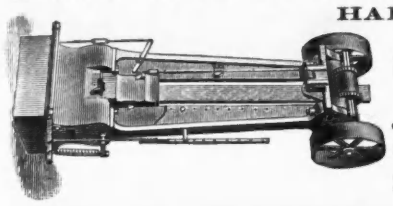

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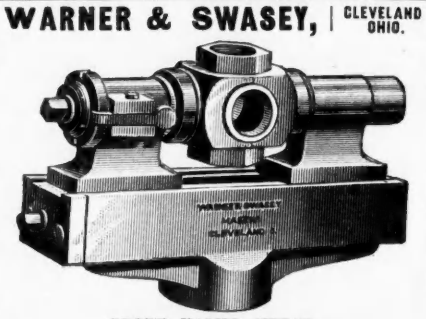

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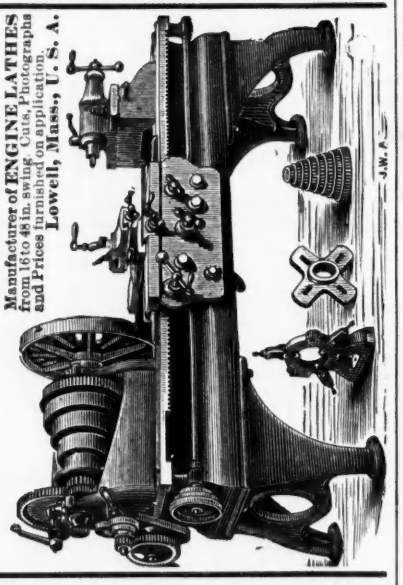

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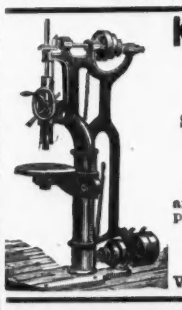

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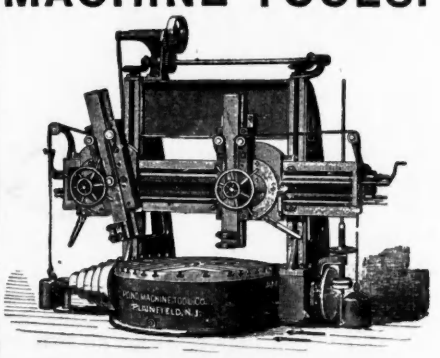

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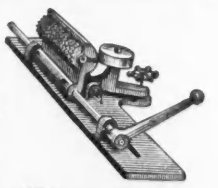

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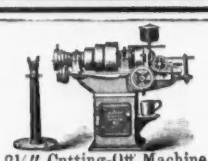

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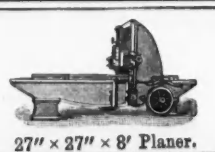

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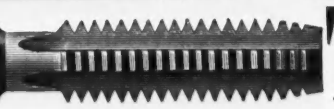

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